DOCUMENT RESUME

ED 238 306 HE 016 601

AUTHOR Crichton, Anne, Ed.; Neuhauser, Duncan, Ed.
TITLE The New Epidemiology--A Challenge to Health Administration. Issues in Epidemiology for Administration.
INSTITUTION Association of Univ. Programs in Health Administration, Arlington, VA.
REPORT NO ISBN-0-914904-84-1
PUB DATE 82
NOTE 130p.
AVAILABLE FROM Association of University Programs in Health Administration, 1911 North Fort Myer Drive, Suite 503, Arlington, VA 22209 ($12.95, prepaid; $13.95, purchase order).
PUB TYPE Collected Works - General (020) -- Reference Materials - Bibliographies (131) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS *Administrator Education; *Allied Health Occupations Education; *Community Health Services; Course Descriptions; Disease Control; *Disease Incidence; Health Needs; *Health Services; Higher Education; *Planning; Public Health; Public Policy
IDENTIFIERS *Epidemiology

ABSTRACT

The role of epidemiology in health administration is considered in 11 articles, and three course descriptions and a bibliography are provided. Titles and authors include the following: "The Need for Creative Managerial Epidemiology" (Gary L. Filerman); "The Growing Role of Epidemiology in Health Administration" (Maureen M. Henderson, Robin E. Scott MacStravic); "The Public Policy Impetus Toward the Epidemiological Approach to Health Planning and Administration" (Robert A. Chernow, David A. Pearson); "The Place and Content of Epidemiology in the Education of Health Planners/Administrators (Anne Crichton); "The Importance of Epidemiology in the Training of Health Planners" (J. Mark Elwood); "Integrating Epidemiology and Health Services Administration: A New Program At Yale University" (John D. Thompson); "An Epidemiologic Perspective for Managers" (K. Michael Peddecord); "The Marketing-Epidemiology Interface" (Roberta N. Clarke); "The Integration of Decision Analysis and Epidemiology in the Education of Health Administrators" (Rebecca Fuhrer); "The University of Toronto's Course in Community Health Appraisal Methods: One Course for All Community Health Professionals" (Raisa B. Deber); and "Information for Health Care: An Epidemiological Perspective" (Kerr L. White). (SW)

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The New Epidemiology— A Challenge to Health Administration

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Library of Congress Catalog Card No. LC 82-82961

ISBN No. 0-914904-84-1

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The New Epidemiology—
A Challenge to Health Administration

I. Overview

1 The Need for Creative Managerial Epidemiology

Gary L. Filerman, Ph.D.*

The most significant changes in health services and medical care in the 1980s will be organizational. The evidence accumulating so far supports this prediction. Although progress in curing specific diseases inches along, the organizational setting of curing is changing rapidly. The most dramatic changes are in the direction of comprehensiveness, increased size, and, as a result, greater organizational complexity. It remains to be seen if these changes represent progress toward improved health status as well as improved access to appropriate care at a reasonable cost.

Consider the rate of change. Significant organizational "innovations" of 1980 are presenting options for ownership, content, mission, and scope that were not considered viable in 1970. The options all move toward greater complexity, comprehensiveness, and size. They include chains (both nonprofit and for profit), health maintenance organizations (HMOs), shared services, service contracting, and a variety of new service centers that are likely candidates for consolidation or linking into systems.

The impetus for rapid changes in health services organizations comes from several sources. Inflation forces health programs and institutions to employ new and more elaborate management systems to control use of resources and to produce optimum returns on investment. Expensive new technology requires evaluation, marketing strategies, organization, and larger service populations. Some organizations have joined health service systems that offer greater specialist management capacity, while others have been forced to merge by financial constraints. In the United States, private initiative for profit has nurtured large systems for both economies of scale and marketing considerations. Nonprofit organizations have followed suit, both offensively and defensively. In Canada, national health insurance, developed as a series of

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separate programs, has been reviewed at federal and provincial levels over the past decade, and is in the process of being restructured into a comprehensive integrated health service.

Of all professionals, the health services administrator has the most to gain or lose in the process of organizational change. The day-to-day role of physicians and other direct providers of services will change gradually in response to modifications in the organizational and economic environment of practice. The administrator's role and functions are being redefined far more quickly. Large, complex organizations require highly developed, specialized management skills; the generalist administrator does not belong in this setting. Large, multipurpose health organizations require and can support specialists with competence in many functional areas of management.

In the next few years, employers will emerge as the most influential force for organizational change in health services. Any examination of personnel costs reveals two facts that compel action by employers. One is that the costs of health care benefits have risen rapidly and will continue to rise, both absolutely and as a proportion of all fringe benefits. As the costs of health services rise, employees will carefully protect their open-ended coverage. The second imperative is that days lost to illness are expensive, and concern about health problems detracts significantly from efforts to increase productivity.

As a result, employers are becoming more sophisticated purchasers of health services. Their direct involvement in the field is increasing rapidly. They are seeking value for the price paid. Value will be measured by reduced illness days, reduced lengths of stay, access to lower-cost alternative and competitive sources of service, and reluctance to support duplicate and unnecessary services. As competition among providers increases, the requirements of the purchaser of services combined with the consumer's awareness of costs will force health service systems to run tight ships, with strict controls reflecting costs and outcomes. No provider organization will compete successfully without effective internal controls on the behavior of its users.

As the costs of medical care, and sickness insurance in particular, have risen, the focus on prevention has increased. The elements of the employee-benefit investment equation are shifting slowly, but the pace of change toward preventive services will quicken as the force of rising costs and the evidence of the effectiveness of prevention converge. Sickness insurance is a no-win expenditure for the employer. It does nothing to reduce work days lost and only sustains the high-cost, high-technology, curative system. Without purchaser control, the costs of sickness insurance can only go up. Therefore, employers and unions are

likely to look increasingly for comprehensive *health* insurance and to providers offering preventive as well as sickness services.

The insurance industry has a long-standing rule that it is easier to sell several products than it is to sell a single product. Consumers, whether individuals or businesses, often have several interrelated insurance needs. The company that offers to meet all those needs can improve its competitive position by offering both economies in marketing and service costs and convenience to the consumer. Similarly, it is likely that an employer will want to buy health services from the provider offering the most complete product line rather than deal with several providers.

In Canada, a federal government report, *A New Perspective on the Health of Canadians*, published in 1974, presented the arguments in favor of preventing sickness. The proposed strategies appended were weak but, in the years since then, federal and provincial governments have reorganized their structures and reviewed policies directed toward promoting health and developing policies on preventing sickness. Considerable support has developed for promoting this "low technology" as a cost-saving measure.

Managing Large Health Systems

Demand for individuals who can manage systemwide functions has increased rapidly. In a single hospital or health program, it is often possible for a competent generalist administrator to oversee directly the many functions of management. A generalist may also be necessary because the organization cannot support a large team of management specialists. The emerging large systems, however, have the scale of operation to support as much management talent as they need. Most management specialists come to health systems with experience in other businesses. They are eager to cope with problems of organizational complexity, resource control, and productivity. Many also think in terms of assessing market needs and potential and of responding by shaping services to respond to demand. Traditional ways of operating health services are being questioned from these new perspectives. If there is a market for preventive services, systems managed with these perspectives are certain to respond by offering them.

The functional specialties of management are well known—personnel management and labor relations, materials management, finance, strategic planning, law, and information systems. Such functions will respond most effectively to the competing values always present in health organizations if they are managed by specialists who understand the unique characteristics of health services. From the generic manage-

ment perspective, assessing needs and some kinds of results are elements of the marketing function. Despite the commercial connotation of the term, the skills of that management specialist as applied to health services are largely epidemiological.

By 1990, the real story of health services organization may be revealed by examining the family health record. Few individuals will have the multiple, fractured, and often untraceable medical records typical of 1980. The family health record will be banked in an information system. The record will cover interactions with a wider variety of health service providers than are now likely to be chronicled. Most providers will be employed directly by the systems, if not under contract to them. The comprehensive systems will provide preventive, emergency, acute, home, and hospice care. Many also will offer consultation in child care nutrition, fitness, sex education, stress prevention, adolescent management, and aging.

Records reflecting such a broad scope of interactions with a health service system have incredible managerial potential. They will reveal the true costs and benefits of services. The typical 1980 pattern of interacting with unrelated providers each time a sickness occurs leaves each provider—such as physician or hospital—with a very short memory and little accountability for any but the most immediate outcomes. A comprehensive system has a long memory and an actuarial perspective of outcomes. Those, such as employers or the government, who purchase expensive health services for large groups or populations will be attracted to comprehensive systems with good track records of demonstrated outcomes.

Both the provider health systems and the purchasers of services have a direct stake in the health status of their clients. Improving that status requires identifying and evaluating options for deployment of expensive resources to reduce or solve health problems. The problems that determine health status are essentially biological, whereas the strategies for resolving them are essentially managerial. The comprehensive health systems scenario for 1990 illustrates why epidemiology is a management science.

The Epidemiologist as Developer of Health Policy

An international conference on the role of epidemiology in health services planning, administration, and evaluation was held in March 1975. Organized by the International Epidemiological Association under a contract with the U.S. Department of Health, Education, and Welfare, the conference took place in an environment of broadening U.S. government health activities, especially in planning. The conference

examined the role of epidemiological methods as tools for policy development and implementation, recognizing that appropriate analysis of options for health services investment and of outcomes is essential to plan community services effectively.

The conference stressed the need for epidemiologists to become more involved in social action processes based on their disciplines. Case studies from Australia, Canada, England, Scandinavia, and the United States demonstrated administrative applications of epidemiology and health statistics. A recurring theme was the need for specialists in epidemiology to see themselves playing broader roles, particularly as direct participants in the development of policy or in the management of health resources (systems). The content and conclusions of the conference are available in a small volume of enduring value.[1]

The explorations of administrative applications have made it clear that underuse of epidemiology deprives management of a particularly potent tool for marketing health services. For years, public health educators, using clinical examples, have attempted to make this point to students of administration with little success. In the context of concrete examples of applications to administrative processes, the point was well made. The conference concluded the following:

> The discipline of epidemiology, together with the applied fields of economics, management sciences, and the social sciences, provide the essential quantitative and analytical methods, principles of logical inquiry, and rules for evidence for:
>
> - Investigating the natural history of disease;
> - Diagnosing, measuring, and projecting the health needs of communities and populations;
> - Determining health goals, objectives, and priorities;
> - Allocating and managing health care resources;
> - Assessing intervention strategies and evaluating the impact of health services.[2]

At this writing, the U.S. government is moving to reduce the impact of regulations on the public. The legislatively mandated health services planning system is being reduced, if not dismantled. This shift in public policy will not lessen the importance of population-based planning and evaluation of health services. Reduced regulation will speed the growth of large systems, comprehensive services, close scrutiny of outcomes, and, ironically, more rigorous internal controls than were ever imposed from outside provider organizations.

If it is to serve the student and the public effectively, education in health services administration must be oriented to the future as well as to the present. The pace of change in health services organization establishes one indisputable given for the future—change itself. The appropriate response of professional education is to identify the skills and insights that will be of consistent and enduring value to administrators. The program graduate should have received a blend of preparation for work in existing health services organizations and for the systems that are emerging. The forces shaping the foreseeable future—increased attention to prevention, service comprehensiveness, and organizational complexity—are all information driven. Information is the raw material of epidemiology, which is the connecting bridge between the population's data and its health status. Competence in health information management is therefore of enduring importance to the professional health services administrator.

Those currently students will be in senior management positions in health service systems by the turn of the century. The present professional education system is not equipped to meet their long-term need for epidemiological skills. A thorough assessment of the epidemiological assets of education, the first step toward improving the situation, would be complicated by lack of consensus among educators about the parameters of the discipline. Identifying courses labeled "epidemiology" would satisfy only classical epidemiologists. Similarly, human resources would be underestimated if the assessment focused on faculty who call themselves epidemiologists and included those who have completed an epidemiology core or minor sequence in a public health doctoral program.

The challenge in assessing resources is to overcome the tendency of epidemiology to claim too little and too much for itself at one time. It claims too little by underestimating the scope of its potential application to health services policy and management. It claims too much by underestimating the extent to which its philosophy, content, and skills can be mastered and taught by those who approach epidemiology from bases in kindred disciplines. An assessment that surmounted this challenge would be a major contribution to the vitality of the new epidemiology required by future students of administration.

In addition to specific courses in epidemiology, the assessment should include parts of courses in medical care, health planning, evaluation, and related topics. As the definition of the new epidemiology expands from a purely health data base to include quantitative methods or management sciences, it becomes clear that the key to surrounding

the discipline lies in its learning objectives. Many quantitative methods courses teach the same analytic tools as do traditional epidemiological courses. Substantial similarities exist between the models used in marketing and epidemiology and the role of the disciplines in managing service-producing organizations. The assessment awaits at least a working agreement on the core of the discipline.

The current role of epidemiology in health administration education is complicated by differing perspectives, if not of politics, of teaching and learning. Many traditional epidemiologists argue that effective learning depends on teaching from a medical perspective. As a practical matter, much epidemiological content is integrated into survey courses or more specialized courses, taught by health service or public health generalists who are not trained in clinical medicine. Medically trained epidemiologists qualified to teach are in limited availability. Undoubtedly, epidemiology as a managerial science is based partly in biology. However, the information upon which it draws is understandable and manageable without a medical education (which includes very little epidemiology). It follows that the teaching and learning of epidemiological methods are within the competence of many individuals, particularly those oriented to the numerative sciences.

Using the broad definition, the epidemiology available to health administration students varies widely in content and style. There are three common patterns. A substantial minority of graduates has had only one or two public health core courses in epidemiology. It is probable that the content, measured in hours and number of courses, has actually decreased in the past decade. The decline reflects both decreased reliance on core courses in general and, in many cases, deliberate decisions about priorities. A low priority is often a response to the differences between the epidemiology faculty's view of what must be taught and the administration faculty's view of what must be learned. The latter may then either integrate epidemiology content into courses tailored to the needs of their students or forgo the content altogether.

Although many health administration faculty members received some or all of their training in a public health setting, few were exposed to managerial applications of epidemiology. The core courses have concentrated on communicable disease and, more recently, on chronic disease applications. The texts emphasize methods. Topics such as probability have rarely been applied to such examples as utilization review. Students are not exposed to the few epidemiological contributions to administrative and policy journals. The perceived lack of courses responsive to the needs of students of administration is, therefore, often the explanation for the low priority given to epidemiology.

Another group of students has been exposed to epidemiology in the context of courses in medical care, evaluation, and health planning. The context may be effective in conveying the potential uses of epidemiological methods, but the courses' basis in epidemiology is often not sufficiently explicit. An epidemiological method does not need to be recognized as such, but the richness of the viewpoint and the scope of the methodology available is often missed in broader courses.

The third curriculum pattern includes courses in quantitative methods, research design, and market analysis. Many of these courses are included in core requirements in business and public administration settings. It is important to note that many programs in public health and medical schools also rely on such courses. Most of the components of the epidemiological method are covered. Those who teach management skills courses may not be aware of the parallels between those skills and epidemiology, and even if they are, they often lack teaching materials that demonstrate the health status applications of their skills.

Even without an assessment of educational resources, it is clear that practicing health administrators undervalue the potential contribution of epidemiology to their own competence. In a recent survey by the Association of University Programs in Health Administration (AUPHA), program alumni said that they rarely use epidemiology in their work and place a low priority on becoming more effectively grounded in it. It appears that academic health administration and academic epidemiology share a significant problem and challenge to demonstrate the relevance of epidemiology as a managerial science.

Epidemiology as a Planning Tool

Since about 1960, community health planning has increased at an unprecedented rate among the North Atlantic nations, and it has embraced more than hospital planning. One result of this increase in planning was the expanded recognition of epidemiology as a planning tool, epitomized by the 1975 conference. With the recent shift to planning by and for systems and preventive services, and the emphasis on systemwide productivity, an assessment of the uses of epidemiology in management practice is imperative. When matched with the results of the proposed educational assessment, the agenda for the development of managerial epidemiology will be clarified.

The difficult decisions facing both public policy and health service administrators illustrate the potential contribution of managerial epidemiology. Clinical and managerial distinctions are increasingly blurred. Furthermore, most have important economic, political, and ethical implications, particularly when resource allocation choices vir-

tually predetermine health status. Rarely can the decisions themselves be called epidemiological. However, to the extent that they deal with populations, a quality, defensible decision-making process requires the contribution of managerial epidemiology.

Here are some examples of management decisions requiring an epidemiological perspective.

- Deciding whether to initiate a preventive program aimed at a particular problem. Determining the range of services to be included. Evaluating the use and efficacy of the program.
- Distinguishing services needed within the service area and those needed by the greater community, compared to the services offered.
- Identifying high-risk populations. Estimating their needs, designing services to respond to them, marketing the services to respond to them, and evaluating the effectiveness of the services.
- Evaluating alternative delivery modes, such as satellite practice groups, ambulatory surgical centers, emergency posts, and day surgery. Identifying alternative investment options, estimating use, and evaluating impact.
- Analyzing use and cost of services used by specific populations (client, employer) groups.
- Evaluating the appropriateness of a health service research report and its applicability to a particular institution, system, or program.
- Evaluating the effectiveness of a new configuration of tasks or a new profession, such as the nurse practitioner, and its applicability in a given situation.
- Identifying the etiology of diseases resulting from exposures incidental to contact with the health service system. Evaluating steps to alleviate iatrogenic disease.
- Deciding on the effectiveness of organizational developments, such as coronary care units (CCUs), or changes in practice, such as expanded use of the coronary bypass. Specifying appropriate measures of outcomes to justify investments in organizational change (for example, CCUs) or new technology (for example, scanners).
- Determining the efficacy of an investment in screening programs, such as cervical cytology, amniocentesis, and breast cancer. Deciding on the scope of the program, marketing to the populations at risk, and evaluating the outcomes.
- Developing the justification for maintaining or increasing investment in health services and presenting relevant supporting data effectively.

Regardless of the organizational forms that emerge or the degree of complexity involved in the health service systems of the future, administrators will confront such decisions with increasing frequency. The 1975 conference sought to encourage timely academic response to the trend. Organizations representing practice and education in several fields were asked to play leadership roles in effectively employing epidemiology in new organizational settings and in policy development processes. The Association of University Programs in Health Administration was among them.

One of AUPHA's attributes is its mix of component institutional units, including schools of public health, business administration, medicine, public affairs, allied health, and graduate schools. The variety of program settings provides access to faculty having heterogeneous credentials and experience with the spectrum of approaches to teaching epidemiology. The association also enjoys a vantage point from which to assess, albeit casually, the place of epidemiology in program content and interests. The conference conclusion concerning AUPHA's responsibility and potential contribution was, therefore, appropriate and resulted in several AUPHA initiatives.

AUPHA has undertaken three substantial and successful efforts to enhance the contribution of critical disciplines to health services administration education: in medical care, quantitative methods, and financial management. A successful strategy requires simultaneous initiatives with multiple and related focuses. The first element of a strategy to strengthen epidemiology is to give epidemiological interests visibility within the context of health administration education. Health administration has successfully established an academic identity distinct from public health. It is now essential to demonstrate the centrality of epidemiology to both.

Epidemiology has been included among the disciplines that meet informally at AUPHA's annual meetings. Faculty from a variety of disciplinary backgrounds and from programs based in all settings have shown consistent interest. Formal sessions devoted to teaching models have attracted a similarly wide range of interests.

It is important for leaders in health administration education to establish a collaborative relationship with leaders in epidemiology. Epidemiology is changing in ways that affect its role in the education of health administrators. Leaders in the discipline can interpret such developments and facilitate response to the needs of students of administration. Several organizations provide leadership in epidemiology, including the International Epidemiology Association, the American Epidemiology Association, the Epidemiology Section of the American

Public Health Association, and the Association of Schools of Public Health (ASPH).

ASPH and AUPHA serve many of the same universities and have a well-established pattern of collaboration. The two organizations have received a Milbank Memorial Fund grant for a joint effort to enhance the contribution of epidemiology to health administration education. The task force supported by the grant is to identify current needs and resources and may develop an action plan focusing on development of faculty and teaching materials. It seems appropriate that both entry-level and continuing education be addressed. A collaboratively developed and implemented action agenda could have a profound impact on the future of health administration education, if not on the scope of epidemiology. An appropriate title for the next publication in this series would be "Developing Managerial Epidemiology for the Year 2000."

It is important to identify and give visibility to innovative teaching responsive to the present and anticipated needs of administration faculty. Epidemiology and health administration faculty have worked together to design new teaching and learning models. Systems engineers and other quantitative specialists have developed rich health status assessment course components. Such innovations went relatively unnoticed so long as epidemiology was not a central interest within health administration curriculums. Innovations must be described and evaluated to stimulate replication.

This volume brings together innovative thinking about the role of epidemiology in health administration and offers some models of program development. It is one step in a strategy to respond to needs for creative managerial epidemiology.

Notes

1. Kerr L. White and Maureen M. Henderson, eds., *Epidemiology as a Fundamental Science: Its Uses in Health Services Planning, Administration and Evaluation* (New York: Oxford University Press, 1976).
2. Ibid., p. 215.

2 The Growing Role of Epidemiology in Health Administration

Maureen M. Henderson, M.D.* and
Robin E. Scott MacStravic, Ph.D.**

Most epidemiologists see themselves as analysts and problem-solvers. Other health professionals who work with epidemiologists have tended to identify them by their areas of interest and the investigative strategies they use. This approach worked well until epidemiologists and other health professionals expanded their areas of interest and adopted each other's investigative techniques. The overlap in interests and research tools requires introductory definitions of epidemiology in many papers and reports to help readers understand the context of the discussions.

Development of Epidemiological Activities in the United States

Epidemiology can be defined as a scientific approach to solving disease problems. It identifies and measures diseases in communities and attempts to find their causes or at least the ways in which the causes and victims come into contact with each other. Its practice has been shaped over time by the nature and sequence of the most common and serious human diseases. Its basic sciences and strategies were built on the study and control of infectious diseases, although concern with the causes of chronic disease can be traced to the 18th century and psychosocial problems were being studied by the end of World War II. As perceptions of disease began to change and the concept of interacting causes of a single disease was accepted, epidemiologists began to search for broader environmental threats to health, as well as for specific harmful organisms. These kinds of investigations showed that the health of newborns was determined by their mothers' childhood environment and that chronic bronchitis among older people was caused by dust particles in the air. This particular phase of epidemiological research

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reached its peak with studies of the health and ecology of total communities.

As cancer and heart disease became relatively more important social problems and attempts to find their specific causes continued to be unsuccessful, efforts to discover the diseases at an earlier stage were intensified. These efforts led to widespread adoption of periodic health assessments and screening for disease. As automation and computers became more accessible and the early results of longitudinal community studies suggested some promise, interest in screening for disease was gradually expanded to include screening for risk factors. Optimism about the likely success of these approaches to disease prevention and control was coupled with the hope that screening programs could provide both access into organized personal health services and a way to strengthen the services themselves. The Regional Medical Program (RMP) legislation and its implementation extended opportunities for epidemiologists to participate in assessments of types of health services, their distribution, and their impact on geographically defined populations.

As new technology was introduced, epidemiology used it in predictable spurts and with some success. For example, new microanalytic techniques and the ability to freeze blood and tissue samples gave a boost to infectious-disease studies, and the capacity to handle large amounts of data and large numbers of variables did the same for chronic-disease research. These "new" technologies had an additional impact on the extent to which the experience of people in the community, not just hospital patients, could be explored. Over the years, epidemiologic research also was able to capitalize on major breakthroughs in biological knowledge, such as the identification of new viruses and the ability to count and identify chromosomes and their abnormalities.

Early epidemiologists in the United States were medical practitioners. They were exemplified by the Epidemic Intelligence Service officers of the National Communicable Disease Center. This elite corps of officers identified outbreaks and epidemics of disease, investigated them on the spot, and found and removed their causes. Their work was made possible by a national monitoring and surveillance network designed to provide early warning of unusual disease experience. Gradually, the prevention and control of most acute infections became an integral part of pediatric practice, and chronic infectious diseases such as tuberculosis came under control. Epidemiologists then moved their base of operations from health departments to schools of medicine or public health. In these academic locations, they switched from community problem solving to

investigator-initiated research, and the only real boundaries to their research interests were determined by the availability of research funds. Those funds happened to be plentiful, and, in fact, decisions to fund research projects were made by peer review groups. Because academic epidemiologists were always relatively few in number and served as members of the relevant peer review panels, their overall research interests and activities remained relatively narrow and stable. In general, they concentrated on questions of disease etiology.

By the late 1960s, many epidemiologists and biostatisticians began to dedicate their professional energies to the design and management of large-scale, multicenter collaborative trials. The growth of these studies was facilitated by the development of computer science and stimulated by the increasing complexity of medical management questions and the relatively small improvements expected in patients as the result of new treatments. The University Group Diabetes Program is a well-known example of these early clinical trials.

These clinical-trials epidemiologists and a corps of Epidemic Intelligence Service officers investigating "new" health problems remain current practitioners. Both groups identify and seek answers to immediate health questions that usually are brought to their attention by program directors or policy-makers who want and will use the answers.

Although some faculty members of academic departments of medical care had used epidemiologic approaches in their research, and most faculty members of academic departments of epidemiology used the story of retrolental fibroplasia to demonstrate the application of epidemiology to medical care, few card-carrying academic epidemiologists considered medical care to be a legitimate field of research. The Regional Medical Program (RMP) was then established. Pressures to improve the outcomes of cardiovascular disease and cancer were coupled with available resources to bring epidemiologists and others into the field. Requirements for evaluation of both RMP projects and RMP programs brought epidemiologists and clinical and administrative colleagues together. Although the expansion of these new interests was curtailed by the failure of the Regional Medical Program itself, some modest successes laid the foundation for collaborative approaches to the evaluation of health services. The place of acute coronary care units was assessed and decisions were made against major national investment in acute stroke units. Nationwide programs of mass screening of lung function and congenital heart disease in children were considered and not justified; enthusiasm for major national investments in multiphasic health testing was reduced. These modest successes were enough to

establish health services research as a legitimate interest for an academic epidemiologist.

Convinced of the growing national need to invest medical care dollars wisely and to base investment priorities on evidence of medical care and disease control benefits, these converted epidemiologists continued to explore opportunities to measure events and circumstances that would curtail disease. Because epidemiology is a relatively small specialty, the actual number of "converted" scientists was small in terms of building a body of research and initiating training programs for future investigators. In addition, the few training programs started in, or in cooperation with, departments of epidemiology were poorly supported. Research funds and training stipends were both relatively small and in short supply. Research and training activities were further limited by the scarcity of well-organized local service delivery programs in which they could be housed.

About this time, the National Center for Health Services Research stabilized its programs and the graduates of its training programs gained visibility. Its major investments were in programs to develop data banks and computing, and its graduating investigators were mainly social scientists.

The concentration of the center's relatively limited resources in these areas had some consequences. The new core of health services researchers, heavily weighted with social scientists, became the peer group that assessed research proposals submitted to it; inevitably they established research priorities. The programs of research became more focused on health policy, financing, and organization, and review groups became less sympathetic to the types of investigative questions raised by epidemiologists. Tragically, the development of computer science became confused with the development of measurements of health and disease that could be handled by computers. How to use a computer and how to describe and measure the performance of a program of service became confused with how to measure and monitor the functions and malfunctions of human beings. Too much money and time were lost in the confusion. Computer science components, data management components, statistical technique components, and epidemiological measurement components are only now being unraveled.

During the early 1970s, public concern stimulated academic interest in both primary care and the rapid incorporation of new scientific information into clinical practice. By the late 1970s, public pressure increased to contain the costs of diagnostic and therapeutic procedures and to find ways of preventing disease. As new departments of family practice and programs of primary care were developed in

university-based medical schools, their academic faculties recognized a need for population-based data and a mixture of epidemiologic and health services research skills to get the information necessary to extend the scientific base for their teaching and practice. Their need opened up new clinically based alliances for epidemiologists and stimulated philanthropic foundations to support efforts to explore the potential productivity of those alliances.

The Robert Wood Johnson Foundation had already invested in a program to give broad training in community health and management sciences to a group of elite young clinicians who would become both academic leaders and clinician solvers of new kinds of medical care problems. In a sense they were the heirs of the Epidemic Intelligence Service. They would be recruited into academic institutions and would teach students how to incorporate the identification and solution of medical care practice questions into their day-to-day philosophy and approach to practice.

Meanwhile, also during the 1970s, the National Institutes of Health (NIH) and other federal agencies, such as the Administration on Aging, were trying to speed up the clinical application of new knowledge by promoting interdisciplinary programs that brought basic and clinical scientists together and tied clinical investigation to community care programs. Many of these interdisciplinary programs not only recruited but mandated clinical epidemiology as a participating discipline. In the past two to three years, NIH has been forced to allocate increasing proportions of its budget to the support of prevention and disease-control research and demonstration programs and to intervention trials. These NIH investments offered epidemiologists positions and funds in specific disease-research programs that included evaluative research and other health services research components.

Besides these investments in the rapid application of new knowledge to practice and prevention, NIH has had to increase its support of research designed to evaluate diagnostic and therapeutic procedures. This policy has been forced by public reaction to the rapid and widespread introduction and high costs of sophisticated medical technology and by public recognition and fear of the dangers as well as the benefits of the new modalities.

Clinically based studies using epidemiologic expertise on the analysis of data from population-based studies have raised questions about traditional medical practices based on experience with selected groups of patients. Some clinicians have begun to use data from the accumulated longitudinal experience of carefully monitored cohorts as the basis for therapeutic decisions. These developments have generated

some impetus and enthusiasm for the epidemiological approach.

As a direct consequence of research opportunities in clinical settings and research opportunities concerned with the prevention and control of specific diseases, epidemiologists are gravitating into clinical settings and dedicated comprehensive research centers and programs. In these positions, many epidemiologists are carrying out research that could be included under the rubric of health services research, even though it is mostly limited to those aspects of health services research concerned with the content and outcome of care. One other factor has added to the progressive change in the location of epidemiological research activities and their concentration on circumscribed aspects of health services research. The philanthropic foundations have promoted training of epidemiologists in medical schools, and the federal agencies have responded both to the National Research Council's report of a national shortage of epidemiologists and to their legislated mandate to further prevention by initiating training and teaching awards (in medical and dental schools, centers, and hospitals) that require candidates to have or to acquire some epidemiological expertise.

In the future, epidemiologists are likely to focus increasing attention on the cost consequences of disease and disability and on the cost versus the effectiveness of alternative technologies for dealing with health problems. Priorities for investigating the etiology of acute and chronic disease, trauma, and disability are likely to be assigned, based on the costs of such conditions as well as on their health impact. With increasing interest in the prevention of, and the least costly therapies for, treating such conditions, epidemiologists will be asked to evaluate the effectiveness of alternative modalities, with special emphasis on cost-saving potential.

Epidemiology's Contribution to Health Administration

The historical developments that have occurred around and within epidemiology help us understand the variety of definitions and applications of epidemiology. Similarly, this variety helps us identify the ways in which epidemiology can be applied to the teaching of health administration.

Epidemiology has made three principal contributions to the teaching and practice of health services administration and planning. First is its general approach, which develops and employs causal models of disease, injury, and disability, varying from simple to complex. These models provide the basis for discovering and understanding the etiology of the development and distribution of departures from health in the community. The second is the set of scientific methodologic strategies

used by epidemiologists to identify the nature and distribution of specific diseases, tracing their etiology, assessing their consequences, and testing the effectiveness of interventions designed to alter or stop their progression. The third is the body of knowledge that epidemiologists have acquired and the contribution it makes to the planning and management of health problems.

Epidemiology can have a variety of implications for management. Some of its fundamental knowledge provides the basis for such routine managerial responsibilities as monitoring and surveillance to prevent nosocomial infections or to maintain safety standards within hospitals and other clinical settings.

Managers can use some of its specific analytical and investigative techniques to address particular problems as they arise. Statistical tools that are part of epidemiology's armamentarium are used to describe bed occupancy and other measures of efficient use of hospitals. Medical care markets can be examined using epidemiological approaches. The systematic detective work it uses to identify causes of health problems and to test solutions to them mirrors the managerial function of identifying causes of organizational disturbances and testing solutions to them, a function that is often carried out intuitively, rather than systematically.

Epidemiology is most visibly used by administrators during institutional long-range planning or in the regulatory planning carried out within health planning agencies. Identifying and anticipating problems, determining their causes, and selecting productive intervention are basic to good planning. All serious planning efforts should rigorously test the range of possible interventions. Although epidemiology offers a strategy for determining the specific impact of each applied intervention, few planners have invested in intervention assessments. It is becoming urgent for planners and decision-makers to apply more than intuitive judgment in assessing the benefits versus the costs of programs before they are implemented.

The basic epidemiologic approach can be, and indeed often is, used to describe and explain the incidence and prevalence of communicable and chronic diseases, injuries, and disabilities in the population at large or in the population dependent on any one institution. The approach has even been used to describe the way people behave in respect to their health.

The clear identification of webs of causation and a complete inventory of the costs and benefits of intervention are perhaps the most essential steps in policy making. Perhaps they are also the most often forgotten steps in policy making. As far as the organization of health

services is concerned, history shows us to be a nation of tinkerers manipulating one part of a highly complex system at a time and being continually surprised at the complex results that follow. Such maxims as, "We have met the enemy and he is us" (Pogo), and, "Today's solution is sure to be tomorrow's problem" (anonymous), reflect this unfortunate and perhaps unavoidable proclivity.

The discipline of epidemiology offers health services administrators a model against which they can assess intervention choices before applying them. a model that can be used to mitigate the historical shortsightedness of many of our health policies. Added to the appropriate methodologies of other social sciences, this epidemiologic methodology can be used to enhance the value and, consequently, the impact of policy research. Political realities will inevitably constrain the impact of such research. However, even they can be modified by better knowledge and understanding of the causes of specific problems and the likely consequences of the available range of interventions.

Epidemiology offers sets of principles and methods for identifying causes of acute and chronic disease and injury. Its causal models are specifically designed to identify intervention or leverage points where the causal chain can be broken, or at least interrupted, most effectively and efficiently. Such a disciplined approach is useful as a model for general problem solving, even if the problems addressed are not related to the health of the population nor specifically concerned with the health of an organization. Similarly, epidemiology offers an approach to identifying and evaluating interventions designed to produce positive results. Its specific methods are useful to determine what changes have taken place since the intervention was applied. This discipline provides useful models for testing interventions at the policy, planning, and administrative levels.

It can be argued that the analytic or thinking aspects of both planning and administration have three requirements:

1. Evaluating existing and predicted problems, threats, and opportunities in the organization and/or its environment, assuming the absence of intervention.
2. Identifying, selecting, and using interventions designed to move the organization and the community it serves in some desired direction (or keep it from moving in an undesired one).
3. Monitoring the current state of affairs to check whether interventions were successful and whether additional problems, threats, and opportunities have arisen.

The basic logic of epidemiology is applicable to all three, since each is a function epidemiology performs.

Apart from its basic discipline and logic, epidemiology is more useful for planning and policy making than for day-to-day management of health care organizations. Its methods are useful, if not essential, in the research behind planning and policy development. Descriptive and analytic techniques used to find causes and to assess interventions can be applied to a wide array of problems and issues. The knowledge that epidemiology has contributed to our understanding of health problems provides the essential context in which planning and policy activities take place.

Teaching Epidemiology to Health Administrators

The teaching of epidemiology logically follows its three distinct components. The knowledge we now have of the nature and distribution of disease and of the complex causal webs that determine the health of mankind should certainly be part of any introductory course in health services. Administrators, planners, and policy analysts should all share a basic appreciation of the nature and causes of the problems that call for their efforts and of the contribution of specific interventions that justify their existence.

The logic of causality, from the simple agent-host-environment triad to the more complex notions of synergistic and sequential causality that epidemiologists have developed and employed over the years, should be taught as a part of planning, problem-solving, or evaluation requirements in the curriculum. Other causal models, such as consumer behavior (marketing), power structure (politics), and systems dynamics (systems analysis or operations research) should also be included.

The techniques of epidemiology are used by other than epidemiologists and can be fitted into basic courses on statistics and research. The limitations as well as strengths of such methods (for example, ecological fallacy, association versus causation) should be discussed. Students of administration should become at least intelligent directors of the applications of these methods and intelligent consumers of their results.

Epidemiologists often see themselves primarily as researchers and scientists who yearn for truth and hunger after the right answer. Administrators, planners, and policy analysts are, at best, engineers; they have to make decisions based on the best information available. A philosophical conflict will always exist between scientists' and administrators' differing views of information needed to reach a conclusion; such a conflict is both understandable and appropriate.

The aim of epidemiology in the health administration curriculum

should not be to inculcate students with the wonders and importance of this essential discipline, but to encourage them to feel comfortable with the knowledge, logic, and methods that epidemiology can contribute to achievement of their goals. Epidemiology contains but one set of the causal models with which students should become familiar. Its methods are not unique but are likely to be claimed by statisticians, social researchers, clinicians, and even marketing specialists.

Epidemiology should not be presented as arcane or esoteric, but as a set of concepts and techniques that differ primarily in their biologic concepts and applications from those of related fields. Health administration must, of necessity, be an eclectic, pragmatic, and empirical discipline rather than a narrow, precise, and theoretical one. Epidemiology should be thought of as a contributor to, rather than reformer of, the teaching and practice of health services administration and planning.

3 The Public Policy Impetus Toward the Epidemiological Approach in Health Planning and Administration

Robert A. Chernow, M.P.H.* and
David A. Pearson, Ph.D.**

Over the past three decades, the U.S. Congress legislated three national programs associated with health service planning: the Hospital Survey and Construction Act, popularly known as Hill-Burton, passed in 1946; the Regional Medical Programs (RMP), passed in 1965; and Comprehensive Health Planning (CHP), passed in 1966. Authorities generally agree that the Hill-Burton program built so many acute care hospitals that the country is now substantially overbedded, that RMP encouraged tertiary or sub-specialty care as a substitute for healthful living or good primary care, and that CHP agencies tried to "negotiate the future without relevant information, fiscal control, or political 'clout'."[1]

These programs have been considered to be largely unsuccessful from a planning standpoint primarily because they lacked a community-based perspective: that is, the programs failed to consider the needs of the population to whom the beds, services, and plans were directed and whose interests they were supposed to serve. Lacking the support of population-based information systems and personnel trained in the quantitative skills embodied in epidemiology, it is not surprising that these programs are now viewed as having been ineffective.

Recent federal legislation has extended planning and regulatory authority in the health field in a number of important areas. The 1972 amendments to the Social Security Act established Professional Standard Review Organizations (PSROs), which are government-sponsored organizations consisting primarily of local practicing physicians that were created to ensure that health services paid for by Medicare, Medicaid, and Title V are medically necessary, meet professionally rec-

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ognized standards and are provided in the most cost-effective manner in the 203 designated PSRO areas across the country. In 1974, Congress passed the National Health Planning and Resources Development Act, which, among other things, replaced Hill-Burton, RMP, and CHP with a uniform, layered planning and development system, extending from the national to the local (health system area) level. The law also requires a state-by-state implementation of certificate-of-need programs, establishes a method for evaluating the continued appropriateness of existing services and facilities, and creates a national accounting system for monitoring the volume and costs of institutional health care services. The act makes frequent references to populations, communities, health care needs, and health information systems. Equally important, the act specifies that each planning agency is to have a staff with expertise in administration, data gathering and analysis, health planning, and development of health resources. In addition, planning agencies are required to collect and analyze data on (1) the health status of the population in the area; (2) the status of the area's health care delivery system and its use; (3) the effect of the delivery system on the population's health; (4) the number, type, and distribution of health care resources in the area; (5) the use of such resources; and (6) the environmental and occupational exposure factors. Clearly these responsibilities mandate the epidemiological approach.

The Limitations of Present Analyses

A major thrust of both the Social Security amendments and the Health Planning Act is cost control. Together, these programs will have a major impact on how health care organizations perform their role in the community. These acts affect the distribution and allocation of resources not only in terms of facilities, services, and reimbursement; they also influence the kinds and amounts of service that health care organizations can produce. Although such decisions have a direct effect on institutions, they also have an indirect effect on the communities served by these institutions, as Wennberg and Gittelsohn have noted.[2] Related questions raised by these authors include the following:

- How much in the way of resources is expended for the residents of the community?
- What cases are treated and what types of therapy employed?
- Are some institutions or communities more efficient than others in treating the same kinds of cases?
- Do decisions made by public agencies, for example, PSROs and health systems agencies, change the situation?

Answers to these questions depend on statistics that link, on a per capita basis, the input of resources and the production of services with the effect of these on health status. If this information were available for different communities, health service areas, or PSRO regions, it would be possible to appraise the effectiveness and efficiency of medical care services in those areas. Further, such information permits an appraisal of the impact of regulatory decisions on the equality of resource distribution.

Documentation of the population's health care experience has been restricted to large political jurisdictions such as states or nations. Studies at this aggregate level have used indicators that permit direct comparison between areas. Relationships between the supply of personnel, facilities, and expenditures and the population on whose behalf these resources were expended are expressed as direct input rates, a familiar epidemiological technique. For example, the number of physicians or hospitals per thousand population and the per capita expenditures for one area can be calculated and compared. The quantity of services produced or the kinds of cases treated are also commonly expressed in terms of "utilization rates." Examples of hospital utilization statistics include the number of days the residents of an area spend in a hospital (patient days), the number of surgical procedures, and the number of cases of a given diagnosis (or group of related diagnoses) admitted or discharged.

The important point is that such statistics are expressed in terms of events per thousand population at risk. These rates are usually calculated on an annual basis and are often adjusted to remove the effect of age as an explanation of differences between regions. These rates are crude indicators because they do not reflect the in- and out-migration of residents. Without patient origin information, the denominator population cannot be determined accurately for a given hospital, group of hospitals, or region. The patient day utilization rate in Connecticut, for example, is likely to be understated because of an out-migration of some residents to hospitals in neighboring states.

Despite this obvious shortcoming, a number of studies comparing states have shown population-based differences in the use of facilities and services that are difficult to attribute to illness rates. Variations in hospital utilization rates between states are large,[3] and Medicare and Blue Cross expenditures per enrollee can be twice as high in some states as in others.[4] Large differences exist between states in the rate of delivery of specific surgical procedures.[5]

The University of Michigan's Bureau of Hospital Administration has been conducting patient-origin studies as part of its planning

services to Michigan communities for nearly 20 years. Several communities have been studied in terms of their service area populations.[6] The Greater Detroit Area Hospital Council maintains patient origin information. Along with recorded patient-day statistics for a hospital or group of hospitals in an area, specifying these denominator populations permits the calculations of accurate utilization rates for a variety of Michigan communities. No sound explanation for the variation that appears on these use-rate data has been developed.

Identifying Ways of Improving Analyses

After studying the Michigan situation, Griffith and co-workers stated several reasons why the use of population-based measures would help reduce or contain health care costs in that state.[7]

First, the authors believed additional analysis was necessary in communities where total patient-day utilization rates exceeded the state average of approximately 1,200 patient days per thousand population. In most instances, the high rates could not be justified in terms of unusual community need, as measured by morbidity and mortality statistics.[8]

Second, determination of the population at risk permits hospital trustees, hospital administrators, and health planning agencies to calculate third-party payment from Blue Cross, Medicare, and other programs in per capita terms for their respective communities. That is, for a given amount of dollars per person per year (for example, a community hospital's total expenditures divided by its service area population), the community receives so many inpatient hospital days, emergency room visits, outpatient visits, and other services. This calculation provides at least a crude translation between insurance premiums and institutional expenditures at the point of control, that is, the administrator and board of directors. By focusing on per capita expenditures, income transfers also become apparent between areas. Because most residents of western Wayne County and Flint, Michigan, are members of the United Auto Workers-Blue Cross health plan, western Wayne County appears to subsidize what Griffith and co-workers consider unnecessary use of hospital services in Flint. The same general case could be made for Medicare payments that are not experience-rated by region; some communities and states subsidize others.

Third, the per-person calculation proves useful in evaluating the location and organization of proposed new programs or services within communities. The probable impact on per capita health expenses, therefore, can be judged in light of benefits and alternative solutions.

Decision-makers in communities (for example, hospital boards, administrators and health systems agencies under P.L. 93-641) "should

insist on having service populations defined, use rates per person calculated and studied, and costs per person of alternative ways to provide the service presented."[9]

Recent studies by Wennberg and Gittelsohn and co-workers[10, 11, 12] reveal the same uneven pattern of resource consumption in the states of Vermont and Maine. These authors also conclude that inadequate attention is paid to the impact of new technologies on the health outcome of communities. A fundamental reason for variations in incidence of surgery, therefore, appears to be an uncertain relationship between the use of specific treatments and the resulting health status of patients. These relationships remain cloudy because a large percentage of common medical and surgical procedures were not evaluated before being widely used, although the evaluation of new procedures seems justified in terms of social costs alone.

Local health planning agencies mandated by P.L. 93-641 and PSROs are in a unique position to control this troublesome problem. Approval of new technologies by health planning agencies could be made contingent on the willingness of local PSROs to develop explicit clinical standards and to undertake prospective evaluation on the effect of new technologies on the health of residents in a given area or region. Such evaluations of health are epidemiological in nature, and it follows, therefore, that comparisons of the treatment experiences of population groups with the effect on health status in these groups conceivably could become a prerequisite for future health services planning.

Summary and Conclusions

Implicit in complaints raised against the health care system in this country, and in the proposition of "rational" planning as a solution to overcome problems, is the concept that population groups receive inappropriate or too costly care, or both. Such concerns have found public expression in recent federal legislation dealing with peer review of quality of care (PSROs) and health planning (P.L. 93-641). In demonstrating the logical relationship between epidemiology and health services organization and administration, this discussion has focused primarily on health care institutions. These institutions were viewed, however, in terms of the communities, areas, or regions they served. Therefore, the principal functions of health services organization and administration—planning, managing, evaluating and analyzing public policy—can be improved by identifying health-related characteristics, events, or outcomes and relating these in turn to populations at risk. As Thomspon states:

> What is required is that this generation of health planners and

administrators be trained to accept the epidemiological approach as an analytic frame within which their problems can be defined and solutions to them fashioned.[13]

Notes

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4 The Contribution of Epidemiology to Rational Planning of Health Services: An International Perspective

Anne Crichton, Ph.D.*

In the mid-1960s, a group of epidemiologists began to develop an international study of health care utilization. Epidemiologists, biostatisticians, and medical sociologists from seven countries were recruited to work together on a project from which it was hoped to learn more about the effectiveness and efficiency of different national health service organizations and patterns of delivery of care.

The coordinator of the project, Kerr L. White of Johns Hopkins University, gathered a group of collaborators who wanted to see their skills used in national and international health planning. The collaborators laid out the arguments for an international approach in a document discussing feasibility[1] and they managed to obtain financing for a study of considerable magnitude.[2,3] This feasibility study report was a crucial document in influencing the direction of applied epidemiology. The argument was that rational planning of health care was not only desirable but possible. Managers of health services could learn the facts, and a cause-and-effect relationship could then be determined.

Their strong convictions and united approach led national governments not only to commit large sums for the collaborative project but also encouraged them to set up health care research programs financed separately from established medical research councils' funding—programs concerned with applying findings about organization and/or utilization of health services to social needs rather than with making new technological discoveries.

However, in the course of working with this interdisciplinary group of researchers, the epidemiologists soon began to realize that although

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**I am grateful to Dr. D.O. Anderson for providing information about the WHOICSMCU study and subsequent developments in Britain and Canada.

their models of utilization may have been rational, they were simplistic. Their techniques could explain mass effects but were not sensitive enough to provide an adequate theory by themselves. They discovered that no single discipline had all of the information and that many other disciplines were using the same or similar tools to probe for answers. There developed among the collaborators in the group a strong desire to bridge communication gaps, to eliminate jargon, and to promote a new cross-disciplinary language for planning. The researchers became more interested in refining methods than in defending disciplinary "turf." Gradually, disciplinary approaches were modified and strongly held theories became watered down as the group members struggled to communicate across disciplines in order to solve the problems they had set themselves. As they began to work together, they developed a commitment to the systems approach, using cybernetic models.

The researchers believed it to be so important to promote the ideas gained through their personal learning experiences in the collaborative project that, in addition to developing data for their own national planning activities, they wanted to make international changes in approach. The vehicle they saw for achieving this goal was the International Epidemiological Association (IEA).

At the next IEA conference, planned for Primosten, Yugoslavia, in 1972, the organization was overhauled and redirected. The new president, Kerr L. White, who had coordinated the international project, brought together a group of keynote speakers from among his collaborators. The theme of the conference was "Health Systems Planning." At the business meetings it was agreed that a strong membership drive should be initiated and a new journal should be published. Control of the association passed from the British disease-oriented epidemiologists to the epidemiological planners, many of whom were working in North America.

In 1973, White was invited to present his own and his colleagues' views in an issue of the *Scientific American*.[4] Meanwhile, three volumes arguing the uses of epidemiology in health planning were produced by the group, which now formed the core of the revitalized IEA.[5, 6, 7]

The Use of Rational Planning Techniques

As their work proceeded, however, the committed epidemiologist-planners became frustrated because their rational techniques failed to provide the simple cause-and-effect answers they sought. They began to realize the magnitude of factors in health service systems and the difficulties in bringing these into focus, let alone under control. The

cybernetic systems approach seemed to have reached a dead end. Yet the social movement that they had started continued to have force, even if some of the original actors reverted to traditional epidemiology, took administrative positions, or retired. The epidemiologist-planners' role as activist has been reconsidered. Views about what rational planners can achieve have been reduced to more modest proportions; the "mercantilist" approach of the 1960s was recognized for what it was—too rational, too unbounded in its claims about bringing understanding of all aspects of health systems. Epidemiologist-planners have drawn back and now ususally agree to become data providers or purveyors of information to systems analysts and administrators. They have recognized that their interpretive role in the world is limited by the techniques at their disposal and by their training. Health systems are too big to bring totally under control, but there is room for rational inputs.

Although science can solve many practical problems for a society, it may also create many other difficulties if the full consequences of particular initiatives are not recognized before they are undertaken. As De Miguel[8] has pointed out, in reviewing health research at 11 levels of the health system, it is impossible for individuals, or even sophisticated groups of researchers, to recognize all the variables in a macro system. The best they can hope to do is to improve middle-range (micro/macro or macro/micro) research and to recognize that this may not provide all the important answers. And others, mainly policy analysts such as Coleman,[9] Marmor,[10] and Klein,[11] have been concerned with analyzing health services decision making. They have considered the limits of rational thinking, reviewed the way plans are adapted to existing structures, and examined the negotiations that occur in making change. Others, such as Gilbert and Specht,[12] have distinguished between rational, bureaucratic, and advocacy planning approaches and techniques. Yet much is still to be learned about planning approaches.

Despite some disillusionment, the contribution of epidemiology to rational planning of health services has become clear. The managers of national health systems—health service administrators—have begun to become aware that a range of important techniques developed by epidemiologists can be incorporated into their thinking during professional training. These techniques of analysis can be especially useful for planning services that are to be directed to populations rather than to individuals, and for directing attention to health outcomes rather than to processes of caring. Health administrators have begun to be aware that these rational planning techniques can be used to expand the "bounded rationality" of bureaucrats' planning.

British Epidemiologists' Involvement in Health Planning

Two of the IEA-inspired epidemiologist-planners' books were published in Britain, where the logic of the National Health Service had, by the late 1960s, led to the employment of epidemiologists and economists in rational planning activities at central and local levels. IEA members were active in promoting the idea that resource allocation should be related to health outcomes (to be measured by standardized mortality data by region).[13]

Training in epidemiology became mandatory for community health specialists on management teams at regional, area, and district levels. A Faculty of Community Medicine of the Royal College certified specialists, and a variety of new training schemes were established—for example, a master's program at the London School of Hygiene for new entrants and other university refresher courses for experienced medical officers of health.

The epidemiologist-planners did not introduce new concepts of rational planning into the British scene, for the commitment to planning was already well accepted.[14] In addition, the restricted achievements of the planning process generated no great disappointment because the limits of rational planning had been explored early. In 1956, for example, Eckstein[15] had discussed "bounded rationality" in bureaucratic planning. Donnison[16] later explained how standing plans could be used to guide decision-makers caught up in making incremental changes. Directions could be set by planners, but politicians would likely take indirect paths when moving toward them.

Epidemiological Contributions to Health-Services Planning in Canada

The British North America Act of 1867 had established the responsibility of Canadian provincial governments for the regulation of health and welfare services. However, the Canadian federal government became involved in the joint development of a national health insurance scheme during World War II as a result of pressures from the provinces to improve social security generally. A series of programs financed by matching grants was introduced gradually between 1948 and 1970, when politically expedient.[17]

Earlier, an attempt had been made to introduce rational health planning into the province of Saskatchewan when a socialist government had gained power in 1944,[18] but that initiative was overtaken by implementation of the federal-provincial health insurance scheme. Soon after the last program in that scheme was introduced (by the Medical Care Act of 1967), the federal government began to examine the general direction of policy development by establishing the Task Force on the

Cost of Health Services to explore the issues.[19] It became clear that the general features of the health care system were now in place and that there would have to be less waste in the future. More careful planning of services was necessary, starting with changed methods of funding. Reexamination of structures and processes of care was also proposed.

In the 1960s, epidemiologists, economists, and sociologists began to urge employers to consider how their special disciplinary skills could be used in more rational planning. Two of the "new-style" epidemiologists in Canada, Anderson and Sackett, were active in promoting the development of epidemiology as a basic course, not only for physicians and nurses (and particularly community health specialists among these), but also as one theoretical approach for health service planners. Both were active in promoting health care research in Canada,[20,21] and both developed new master's programs—for health planners and health service evaluators, respectively. Sackett[22] also promoted a series of seminars and slide tape shows (funded by the National Health Research and Development Program) through which applied epidemiological skills were taught to a growing body of students anxious to become health care researchers. Meanwhile, Anderson obtained funding for a Health Manpower Research Unit, which was to become an extensive data bank in British Columbia.[23]

Gradually, influenced by these men and other academic leaders, the health administration programs in Canada have been developing and/or revising their curriculums to meet the need for more scientific and analytic content and for greater skills in planning for change, whether in governments or in service institutions. The teaching of epidemiology in the University of British Columbia (UBC) and Toronto programs is discussed in later chapters. In the UBC program, the other strong component is the teaching of policy making, whereby students are taught to consider when rational planning is appropriate and what other rationales may influence decision making.

The "new" epidemiology has had an important effect upon Canadian health services administration programs.[24] It has taken the federal and provincial governments some time to recognize the importance of increasing the level of skills among Canadian health service administrators. However, it seems likely that, before long, the influx of better-trained health services administrators will make important contributions to the planning of Canadian health services.

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II. Programs with an Epidemiological Approach to Administration and Planning of Health Services

5 The Merger of Epidemiology into Education for Health Administration

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The expansion of knowledge has been compared to a balloon being inflated. As the balloon expands, points that appeared adjacent begin to separate from their neighbors and new points become visible. Twenty years ago, epidemiology, biostatistics, and health administration would have been visible and adjacent. As knowledge has expanded, new subject areas have come into view: health marketing, decision analysis, cost-benefit analysis, health economics. Traces of these ideas were all there in the uninflated balloon, but now their appearance is clear, and it is time to become explicit about their relations and boundaries and their implications for the education of health administrators.

Assume that the goal of health administration is to provide the most benefits possible to a defined population with limited resources. What are the benefits of medical care? What are the characteristics of the population served? What services are to be provided when it is impossible to provide them all? A working knowledge of epidemiology is required to cope with such questions, but training in one of the areas mentioned above is becoming increasingly important. Many epidemiologists devote their time to unraveling causes of disease. Which characteristics of highly educated British Columbian women and their environment (see Dr. Elwood's chapter) lead those women to have a higher rate of breast cancer? Knowing the answer to this question might help reduce the cancer's incidence. As important as this question is for research, it is not the central question for the health manager. Managers need to know how many women there are, where they live, and their age

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distribution in order to mount an effective early detection program. Epidemiology can address these questions.

But what if the detection program is put in place and no women come or too many come? This is where health marketing can come into play. As Dr. Clarke indicates in her chapter, epidemiology and health marketing cover similar ground, although they use a different language. What are the benefits of early detection of breast cancer? The usual answer is prolongation of life. By how much? It is typical of much of medicine that we do not know the answer to this question. The skills of epidemiology can show why we do not know. But the problem is more complicated. A running controversy concerns the type of surgery for breast cancer: the traditional extensive radical mastectomy versus the simple and limited lumpectomy. If this question is pursued, we soon realize that the benefits have been misstated. A better statement of benefits is a trade-off. "The fear of cancer versus the desire for bodily integrity." Traditional epidemiology is not equipped to cope with analysis of these kinds of quality-of-life benefits; however, marketing is.

Decision analysis also approaches this problem under the jargon term "multiattribute utility analysis." Should a breast cancer detection program be mounted in the first place? Is it cost effective? The health manager must decide whether the detection program should be funded if it means forgoing the purchase of another CT scanner. This is where the kind of decision analysis described by Dr. Fuhrer can be useful. Her chapter shows how the application of epidemiologic data can change the expected mean level of benefit. Again, we see why epidemiology must use decision analysis, cost-benefit analysis, and probability theory—all areas that do not fall within the realm of traditional epidemiology.

It is my belief that health managers and planners need to know some aspects of epidemiology, but not all of them. They need to be able to fuse a general knowledge of the field with decision analysis, statistics, health economics, and health marketing. If students are asked to take separate courses in traditional epidemiology, economics, statistics, and marketing, they may still be unable to grasp both the relationships that Dr. Clarke presents and the analytic skills that Dr. Fuhrer presents. Instead, they will spend a lot of time learning things of distant relevance to their careers. The rate of colon cancer among the African Bantu. the retailing techniques of supermarkets, and the role of the Federal Reserve Bank—however fascinating—are not concerns central to the needs of a North American health manager.

I doubt that many academics today can pull these strands together. We need to develop such people. Even if no such person or course exists today, the director of a health administration program should be alert to

these boundary issues and work toward developing integration between disciplines.

The chapters that follow present examples showing how various health administration programs have drawn epidemiology into their curriculums. These include programs at the University of British Columbia, Washington University, the University of Toronto, and Yale University.

If the United States moves toward national health insurance as Canada has, health services management will become increasingly population based. What resources are needed to detect and treat breast cancer? It is hard to know how to answer this problem without understanding population characteristics, patient preferences, benefits derived, and costs. Answering this and similar questions is what this book addresses, and that is why you should read it.

6 The Place and Content of Epidemiology in the Education of Health Planners/Administrators

Anne Crichton, Ph.D.*

The University of British Columbia (UBC) has developed a rather different approach to the education of health service planners, administrators, and researchers at the master's level than that of traditional hospital administrators' training programs. This chapter describes the content of the courses that four epidemiologists have been teaching and discusses the place of epidemiology in this particular approach to the education of health service planners.

The Content of Epidemiology

First, the students are required to learn about the methodological approach of epidemiologists—how the search for causes of infectious disease led to rigorous examination of methods of judgment and causal inference. Susser has explained how "the processes of statistical inference, those of causal inference and those of reaching decisions often overlap, but the principles that govern them are not the same."[1] This introductory epidemiology course follows a course on biometrics and is taught concurrently with a course on research methods in the social sciences.

All students are required to take a course in planning developed and taught by an epidemiologist. This course tries, among other things, to demonstrate to the students how they can apply epidemiologic methods in planning. By bringing in local planners for discussions, rational, bureaucratic, and advocacy planning approaches can be examined and the usefulness of different models of planning can be considered. Because the practicing planners raise political and administrative issues in their discussions, this course has now become closely linked to teaching health policy, as well as to the scientific courses.

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In addition to the methodology and the health services planning courses, the program includes a course on program evaluation taught by a nurse-epidemiologist. This course, an elective, is popular with the students because they have been asking for more courses that give them salable techniques, and this is one technique they perceive to be in great demand today. A fourth course in advanced epidemiology, taught by Mark Elwood (who describes his approach in a subsequent chapter), completes the offerings.

D.O. Anderson, a prime mover in developing the degree program, also established a Division of Research and Development within the Office of the Coordinator of Health Sciences. This research center has provided part-time work, and has directed study options and thesis topics for many students in the program. (The epidemiological approach of the center has been described in *Epidemiology as a Fundamental Science*[2] and *Epidemiology and Health.*[3])

The epidemiologists associated with the program are distributed along a continuum—methodologists are still operating in the traditional model of McMahon and Pugh;[4] the planning and advanced epidemiology teachers have been trying to demonstrate how epidemiological thinking can break out of its traditional mold, which uses strictly controlled trials, into the new territory of practical health planning; and research scholars, involved in evaluating programs, are teaching skills to those who will soon be asked to make program impact assessments.

A New Approach to Teaching Health Administrators

What, then, is the place of epidemiology in health administration education at UBC? The Department of Health Care and Epidemiology saw a need to educate a new kind of administrator for the Canadian health system in the late 1960s. Although the four existing hospital administration programs produced enough graduates to supply the larger hospitals with skilled manpower, no program was geared especially to educating the employees of Canadian governments. These bureaucrats were beginning to be expected to integrate the range of health care programs that had been separately developed.[5] The educators at UBC foresaw that a better-trained cadre of public servants would be required to assure more efficient and effective organization of services, to promote change rather than to be employed in institutional maintenance activities.

Although UBC recognized this need, some governments were hesitant to change their policies on recruitment and training of staff.

Our own provincial government especially lagged behind others. Although the government is now aware of the advantages of employing graduates of the program, the first government post with a job description written for a trained health administration graduate was not advertised until 1978.

Chart 1 shows the problems associated with the employment situation. The career paths are not clear, apart from those of the one-third who are government-sponsored candidates (who, it is said, will now diminish because of tight money and recent greater availability of master's graduates in health administration in Canada). The prospects of transferring between hospitals and government are very uncertain. Pension and fringe-benefit problems and union agreements give priority to those already in one service or the other.

In developing the program, we have worked most closely with the government of British Columbia's public health service, which obviously likes the epidemiological approach. The hospital service has not been so happy with the program because it does not have sufficient management content. In the past, the government administrators have not given much indication of their response, except to meet with the students on request. However, two new administrators, who have just moved into top provincial posts, seem more interested and aware of the potentialities of the program's graduates as government employees.

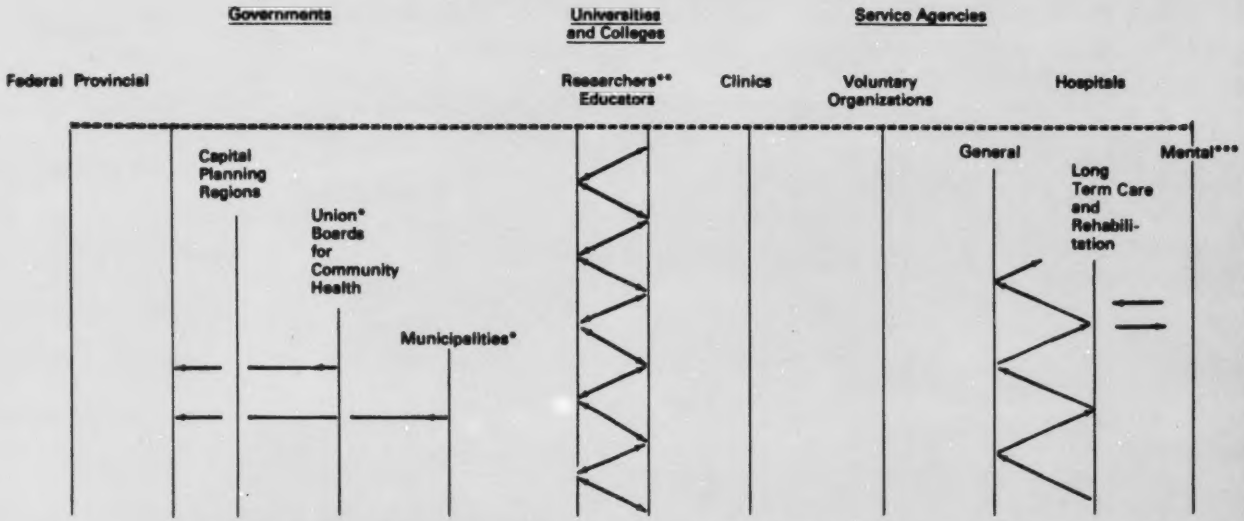
Accreditation Issues

The criteria for the approval of programs in health administration in the 1960s could not have been met by the UBC program when it was established in 1972. Nevertheless, it was decided to go ahead with a new approach to teaching health administrators. Instead of concentrating on producing graduates with management skills, it was proposed to educate policy-makers, planners, and researchers with some administrative skills. After some discussion inside the university, it was decided to call the program Master of Science in Health Services Planning (rather than Master in Health Administration) to indicate this difference in approach. Now accreditation rules have been changed and we anticipate meeting the new criteria without great difficulty.[6]

Career Structure Issues

The lack of an established career structure for health planning in Canada has made it difficult to spell out unambiguously the objectives of the program. This has created problems, because some employers

CHART 1
Present System of Career Development of Health Administrators in Canada
(little cross-over)



*There is some crossing over in the west between employment with union boards, municipalities, and provincial governments, but not between regional districts and other levels of government. There is some potential linkage in Manitoba and Ontario between provincial governments, regions, hospitals, and colleges through shared pension schemes, but there is little crossing over between streams.

**University-based researchers are frequently nontenured and funded by granting bodies.

***Mental hospitals are within the provincial public service system so there is some interchange with community mental health, provincial administration, and, occasionally, the general hospital service.

Note: The dotted line shows some interaction at the very top level, but there is little below that except where indicated.

assume that planners are "backroom boys"—technocrats working out blueprints for their employers.

Gilbert and Specht suggest that there are three planning orientations—technocrat, bureaucrat, and advocate.[7] Many students were disappointed at first that we did not provide a more technocratic training. They kept asking for more practical skills to be taught, as they felt inadequately prepared to be technocrats except in research assistant positions.

They have been more successful in getting bureaucratic posts. About one-third of the first 93 students enrolled in the program were civil servants sent by governments—planners from other provinces and medical officers or community nurses from British Columbia. The rest, who came independently without sponsorship (many on a part-time basis[8]) have been successful in getting administrative-planning or consultant positions. The M.Sc. students have not yet been successful in competition for advocacy-planning appointments, since advocacy-planning employers perceive that the School of Social Work and the Faculty of Law are the training centers for advocates.

Program Content

Our concept of health planners is broad. Compromises have now been worked out and, we hope, are being made clearer to employers and students. We have tried to make clear that the emphasis is on teaching how to analyze situations, but we have added some courses that discuss techniques of management, evaluation, and so on.

The three streams in the program—planner-administrators, researcher-administrators, and community health workers—are now required to take a common core of courses. Following the prerequisites, which are statistics, introduction to administrative studies, microeconomics, and introduction to clinical medicine, the common core is epidemiology, research methods, organization theory, health economics, and organization of Canadian health services and health policy in the context of Canadian social policy. The planner-administrators take elective courses in planning and administration; the research-administrators take elective courses in research methods; and the community health specialists take prescribed courses specific to public health, such as microbiology and engineering, because they are also working toward a Certification of the Royal College of Physicians and Surgeons of Canada.

Gradually, with growing experience, we have been able to reduce the number of core courses and to increase the number of elective choices, so that in the future two-thirds of the course requirements will

be discretionary. The wide interests of candidates can be matched to the wide range of potential study opportunities. All students are required to write a thesis, but each chooses a topic of special interest. So far, no residency requirement has been mandated, although an elective summer clerkship of three months spent in a government department or health service institution is encouraged. More students are showing interest in clerkships because in these carefully chosen settings, good thesis topics can usually be found, as well as opportunities to try out new professional roles.

In addition to the four epidemiologists and three biostatisticians who contribute to the program, two sociologists, two public health specialists (also trained in epidemiology), and a health systems engineer have full-time or part-time appointments in the department. The program is serviced across campus (to the extent that we can use their assistance) by four organization-theory experts, two health economists, and an anthropologist. Many clinical professors teach classes in administrative practice or assist other faculty in particular areas of expertise, such as program evaluation and biomedical engineering.

Difficulties of Developing Health Planning/Administration in a Traditional University Setting

Charts 2 and 3 show some of the reasons for our particular orientation. They show, across the top, the standard natural and social science disciplines, bounded areas of concern, each of which has developed its own techniques of scientific study. Along the sides are arranged the "action orientations" or professional approaches that have customarily used input from several scientific disciplines.

Many hospital administration courses were started in universities in earlier, less sophisticated times when no technical institutes or community colleges existed to complicate the picture. But the growth of these colleges has encouraged universities to differentiate themselves, and a certain amount of stratification seems to have taken place. UBC is not a technical university. It has become more concerned with policy analysis and advanced business studies than elementary management or introductory accountancy.

The tightening of tenure regulations in traditional universities like UBC appears to be forcing peers to look for analytic scientists rather than teachers of practical skills, particularly in political science departments and faculties of commerce and business administration (where the word administration is becoming unpopular because of its practical connotations). Perhaps one could argue that UBC's epidemiologists, by moving in the opposite direction, are filling some

CHART 2
The Teaching of Social Science to Students of Health Care
(available options)

Philosophical Orientations
The Basic Disciplines

		Physics	Chemistry	Biology	Anthrop.	Sociology	Psychology	Economics	Etc.
Political Science	Political science					political behavior			
	Policy					political policy development			
	Public Admin.					public administration			
Business Admin.	Business science					organizational behavior			
	Corporate policy					Health services and Hospital Management			
	Admin. & Management								
Social/ policy admin. work	Social Science				medical anthropology	medical sociology			
	Social policy					health and social service dev.		health and social service dev.	
	Public/ social admin.					health and social service organization		health and social service organization	
Health Care	Medicine/ hygiene			Epid. method.		organizational behavior			
	Health policy			Planning	3rd world policies	Health policy planning		Health economics	
	Health Admin.			Program Evaluation Clerkships	clerkships	Program Evaluation clerkships	Personnel Management clerkships	Program Evaluation clerkships	
Etc.									

It is suggested that three distinctive levels of education are emerging in professional schools: scientific, policy analysis, and administrative skills.

CHART 3
Matrix Showing Approaches to Social Science Investigations

Philosophical and Ideological bases of study

Disciplines

Philosophical/Ideological Orientations	Anthropology	Sociology	Demography Epidemiology	Psychology	Economics
Political Science a) Study of Politics b) Study of Public Policies					
Commerce and Business Administration					
Social Policy and Social Administration					
Community and Regional Planning Social Work Training					
Health Services Administration					

sort of a gap. Their scientific merit is not questionable, and they are searching for teaching situations and opportunities to apply their learning to practical problems. As a result, our program's planning skills are strong, our management skills less so.

Conclusions

The UBC program is heavily weighted with epidemiological content. It is geared to training planners, not maintenance administrators. Attempts to strengthen the maintenance-administration content have not been very successful. We want more management skill training, not more organization theory, and this kind of teaching does not seem to be readily available on campus. We plan to tackle the problem by recruiting more clinical instructors with good theoretical knowledge. While this is a weakness of our program, the range of epidemiological approaches are its strength. The students say that the methodology courses help them think clearly. They enjoy analyzing planners' activities and are beginning to become a little more sophisticated about the possible uses of program evaluation. These last two approaches tie epidemiological method to the realities of health planning. The epidemiologists in the planning area are very much in touch with the rest of the program faculty. It is with the methodologists that we have had most trouble communicating.

We are responsible for teaching our students how to order their way of looking at and relating to the world. The boundaries of health policy analysis are becoming so broad that it is important to reconsider the structures of programs preparing master's candidates for employment. It is argued here that in courses preparing students to promote change in health systems, a strong emphasis on epidemiological content instead of the traditional administrative approach may provide an alternative way to approach the issues. It provides the students with a solid scientific background for examining the issues and, given that they also have courses on policy and organization to orient them to the broad context of their work, they should be able to introduce new ways of thinking about problems into established settings that are faced with the need to adapt to change.

Notes

1. M. Susser, "Judgment and Causal Inference: Criteria in Epidemiologic Studies," *American Journal of Epidemiology* 105, no. 1 (January 1977): 1–15.

2. K.L. White and M.M. Henderson, eds., *Epidemiology as a Fundamental Science* (New York: Oxford University Press, 1976), pp. 17–43.

3. W. Holland and S. Gilderdale, eds., *Epidemiology and Health* (London: Henry Kimpton Publishers, 1977), pp. 174–96.

4. B. McMahon and T.E. Pugh, *Epidemiology Principles and Methods* (Boston: Little, Brown & Co., 1970).

5. *Canada Year Book, 1979–80* (Ottawa: Information Canada, 1980).

6. The program was accredited for one year in 1979 and it was anticipated that a three-year accreditation would be granted in 1981.

7. N. Gilbert and H. Specht, *Dimensions of Social Welfare Policy* (Englewood Cliffs, N.J.: Prentice-Hall, 1974).

8. About half of the students have either embarked on the program as part-timers or shifted into part-time work in the second year, for we have had no special funds to support them.

7 The Importance of Epidemiology in the Training of Health Planners

J. Mark Elwood, M.B., M.D., F.R.C.P.(C)*

The University of British Columbia (UBC) program, described by Anne Crichton, is directed toward the training of health planners rather than administrators. This chapter, which is a continuation of her discussion, is concerned, therefore, with "health planning" rather than "health administration." These are different concepts. Administration suggests a static situation in which the emphasis is on the efficient management of a preexisting system. Planning implies a dynamic process that is effective as well as efficient. Planning, even more than administration, often requires the sound application of epidemiological principles.

Epidemiology is a frequently misunderstood subject, perhaps because of two characteristics: it is too easy and it is too difficult. Epidemiology seems easy—especially to physicians—because unlike, for instance, microbiology or atomic physics, it requires no elaborate equipment and no essential technical expertise; its terminology is not extensive and appears simple. Thus, anyone with pen and paper can be an epidemiologist—or try to be one. However, it is a difficult discipline in that it is tightly logical, with many subtle traps for the oversimplistic thinker, and has an essential quantitative and mathematical core. Thus, epidemiology is easy to attempt but difficult to do well. An essential requirement for basic courses is that they introduce the student to both the range and the difficulty of the subject—which are both almost always much greater than the student suspects—with the hope that a few students will be intrigued enough to become passable practitioners of epidemiology, and the rest will realize when and where this type of expertise is needed.

Method and Subject

What is epidemiology? It has been described as both a method and a subject. A set of methods exists that can be defined as constituting

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"epidemiological methods." However, most of the methods overlap with other disciplines. For example, epidemiological methods include the use of vital statistics and the interpretation of incidence, prevalence, and mortality rates, which are also the preserve of the demographer and the vital statistician. They include surveys using sampling and questionnaire approaches, which overlap with sociology, as well as studies of the outcomes of people with different characteristics and of features commonly occurring in patients with certain diseases, both of which are closely related to studies performed by clinicians. Epidemiological methods include the use of multivariate risk models and studies of the occurrence of disease in space and time, both of which are biostatistical methods. Thus, if one wishes to belittle the place of epidemiology, one could with accuracy say that its methods can to a large extent be obtained from other disciplines, but this statement would not be just. However, any science must necessarily overlap with others. Is a molecular biologist studying DNA by x-ray diffraction a biologist or a physicist? Is a geologist analyzing ore samples doing geology or chemistry? A scientific discipline is recognized not by its component parts observed separately—otherwise any quantitative science is really mathematics—but by the way in which the components are fused and directed.

It seems better to define epidemiology by its subject matter than by its methods. I offer two definitions: the first has the authority of the leading standard textbook and is "the study of the distribution and determinants of disease frequency in man."[1] The other, which I prefer, is simply "the study of the occurrence and natural history of human disease." These definitions emphasize the central place of the concept of disease occurrence. No other science concentrates on this issue. Pathologists study the nature of disease, clinicians the diagnosis and treatment of disease, demographers the effect of disease on population structures; but only epidemiology has as its central focus the occurrence of disease.

As for *epidemiologists*, the best definition is the one used by George Knox—someone who does epidemiology.[2] Such a definition is the only sensible one for a new science, whose most distinguished practitioners have mostly risen from the ranks of other disciplines such as clinical medicine, biostatistics, sociology, nursing, or health services administration.

So one can ask two questions in relation to the education of health planners: (1) What do they need to know about the occurrence and natural history of human disease? (2) What do they need to know about the methods that have been developed for the study of the occurrence of

disease? To answer these questions in full is a mammoth task, but a few examples relevant to different aspects of the planning process may be illustrative.

An important job of the planner is to identify problems and rank them in order of priorities. It takes little specific training to list and identify problems. The simplest method is to do nothing, sit in one's office, and wait for the complaints to flow in. In fact, this is the traditional method of identifying problems in the health care area, and one still practiced today by many politicians and not a few health care administrators. However, most societies are aiming at ways that in some way allow us to give priorities to problems in a somewhat objective manner. This can be done by an economist, based, for example, on the costs of current medical care; or by a sociologist, based on the sampled opinions on priorities; or by a politician, based on the most attractive electoral package. All these systems have their own validity and utility. However, the trainee planner should also be aware of the epidemiological approach that would base this priority listing initially on the relative magnitude of occurrence rates, either incidence, mortality, hospital admissions, years of life lost, or some other measure.

In Canada, this epidemiological approach has demonstrated that the major health problems, as defined by years of life lost, are not necessarily those emphasized by the providers of highly technological medicine, but diseases largely amenable to alteration of personal lifestyle. A government-produced report indicating the need for reassessment of our priorities in the light of such findings received enthusiastic comment both in Canada and abroad.[3] Sadly, this hopeful start has deteriorated as other methods of judging priorities have again become paramount; thus in 1978 the same federal government decided to cut back drastically its support of research into such environmental and lifestyle causes of disease, and to increase its support for basic laboratory and high-technology research.

Given that a specific problem has been defined, it is essential for logical health planning to know the answers to the classical epidemiological questions about any disease or ill-health status: what is it, how big is it, who gets it, when does it happen, and where does it happen? For example, breast cancer and cervical cancer show strong and contrasting socioeconomic differences. Breast cancer is most common in affluent, educated women, and so in British Columbia a study of the occurrence of this disease in UBC faculty and faculty wives has been started, as this group may offer a good potential for a mammographic screening service with a high yield. Conversely, we have shown that native American Indian women have 4.5 times the risk of death from

cervical cancer than do white women in British Columbia.[4] This is likely due to the provincial cervical cytology screening program's failure to reach these native American Indian women, despite the fact that it is the most effective program in the world in regard to the proportion of the total population which is screened regularly. The native American Indian women tend to be irregular users of medical care, and so special methods must be developed to reach them with the screening program.

It is obvious that coronary artery disease is a major health problem. In the 1950s and 1960s, the major approach to this problem was to provide more and more complex medical care, culminating in the development of in-hospital coronary care units—very expensive operations that were very impressive to doctors, patients, politicians, and television scriptwriters! However, a study of the natural history of coronary artery disease done in Belfast in the mid-1960s showed that 38 percent of deaths from this disease occurred within one hour of onset, and yet the median time from the onset of symptoms to admission to the excellent coronary care unit in the major Belfast hospital was eight hours.[5] Obviously, the care given was aimed at the wrong point in the natural history of the disease. The Belfast studies led quite rapidly to the development of mobile coronary care units that have been successful in dramatically reducing the interval between symptoms and first contact with medical care.

Further development of this line of thinking has demonstrated that it is not simply the first hour, but the first few minutes that are the most dangerous, and that the most highly fatal type of heart disease is one in which the first symptom is sudden collapse, and there is no chest pain or breathlessness. This removes much of the logic from the Belfast system, which depends on the rapid response of the medical-care system to the onset of symptoms. Other approaches, as in Seattle, have therefore gone the route of providing paramedical aid for any sudden collapse by training large numbers of the lay public to give immediate cardiopulmonary resuscitation.[6] Thus, increased knowledge of the natural history of this disease has first shown that traditional care is irrational, and then led the way to more logical methods of intervention.

The major impact of good epidemiological training will be in the area of evaluation. Because epidemiology is a biological science, its approach to evaluation is based on the concept of efficacy—that is, does the system produce a useful outcome in terms of measurable indexes of health and disease? The health planner should be aware of the necessity to insist, whenever possible, on biologically meaningful outcome measures. For example, it has been shown that a screening program for hypertension instituted without highly efficient long-term follow-up

may dramatically increase the number of diagnoses, but lead only to increased sickness as assessed by absence in work, without any benefit in terms of adequate control of the diagnosed hypertension and its sequelae.[7] Radiographic lung-cancer screening produces earlier diagnoses, but the patients die at the same time and so the only effect is to shorten their lifespans before diagnosis.[8] On the other hand, improving admission speed to an in-hospital coronary care unit may increase both the length of stay and the in-hospital case fatality rate, despite being a beneficial procedure. The use of erroneous outcome measures is a common problem that adequate epidemiological training should minimize. Of course, for economic or political reasons, it may be possible to assess a health care service only in terms of a functional outcome such as the number of services provided or the average length of stay, and in many situations this may be quite adequate. However, we hope that planners will realize the limitations of such measures, and even if more extensive evaluation is not possible at once, they should attempt to set up, from the beginning of any new program, a data system conducive to the estimation of more biologically oriented outcome measures at a later date.

The most rigid and scientifically valid mode of health care system evaluation is the randomized trial. The trainee planner should be aware of the importance of this method so that it is always considered early in the development of any radically new program. Although we do not know all we would like, we do know much more precisely the potential benefits of mammographic screening for breast cancer, based on 10 years of experience and one randomized trial, than we know about the effects of cervical cancer screening, after 25 years of experience but no randomized trial. In the absence of a randomized trial design, evaluation is much more difficult but is still essential, and sophisticated techniques may be necessary. An example of this situation is fetal monitoring. This is a technique in which electrodes are placed on the scalp of the baby during delivery to give early indications of fetal distress. The practice is expensive in terms of equipment and staff, and it seems to lead to increased caesarean section rates with concomitant increased costs and morbidity. Because it is a technique, rather than a new drug, it has been introduced on a large scale without any scientifically rigorous trial.

Most published studies of its benefits are grossly oversimplistic and consist of before-and-after comparisons that show that the perinatal mortality rates have fallen in hospitals after the introduction of fetal monitoring. As one might expect, they have also fallen in many other hospitals without such equipment. The situation where one wishes to evaluate the effect of one factor, in this case fetal monitoring, on an

outcome, such as perinatal mortality, in the presence of many other factors that affect the outcome, is of course what epidemiological methods are designed for. A quite reasonable evaluation of fetal monitoring has been made using a multivariate mathematical model on a large retrospective study that has demonstrated that fetal monitoring is useful, but only in a very small subset of pregnancies, such as premature deliveries in women of a lower socioeconomic class who have had very little prenatal care.[9] This study has also demonstrated that the women who get fetal monitoring are precisely those who do not need it; they are women from a higher socioeconomic class who come into the hospital on prearranged days at full term for a routine delivery.

The most important "method" of epidemiology in this context is the logical interpretation of studies that demonstrate association between events in terms of causal relationships. Many local traps must be avoided. Better survival of patients diagnosed by screening need not mean that the program is necessarily beneficial. People who volunteer for anything are abnormal—or at least atypical—and cannot be compared to those who do not volunteer. Mortality rates from cervical cancer have decreased in the United States since the introduction of cervical screening—but they had been falling already, so more extensive studies have been needed to demonstrate a causal relationship. Elderly men who are heavy smokers have lower blood pressures than do elderly nonsmokers—not because smoking reduces blood pressure, but because men who are both hypertensive and smoke don't live long enough to be elderly. The 10 percent of people with the highest blood sugars on a sample survey will show impressive decreases when retested—with or without treatment.

Three Types of Epidemiology Students

An important consideration in our teaching of health planners is to imagine their future roles in regard to epidemiology. I think that we can identify three groups—some are born epidemiologists, some become epidemiologists, and some have epidemiology thrust upon them. First, we find that a few students in each class have a well-developed interest in epidemiology and wish to pursue careers in which, in actuality if not in title, they will be doing epidemiology. Obviously, for these few we must provide as high a level of instruction as possible, and certainly something beyond the usual basic course.

The second group is usually the largest—those who are not potential epidemiologists but who wish to pursue planning, research, or management careers with a highly professional and scientific approach. It is essential to let these students become aware of the range of

epidemiological techniques and methods, because in much of their later work they will be dealing with these issues, and they should be able to seek collaboration with more specialized epidemiologists to their mutual benefit.

The third group, it is hoped, will be small, at least in the UBC program. These are the students who are looking for a comfortable static position in which they will supervise the smooth running of an established operation and avoid, if possible, the development and evaluation of new services. They may find, however, that evaluative procedures cannot be avoided, and they should be shown, at least, that epidemiologists are not necessarily totally negative critics, but can be sympathetic, practical, and supportive. It is important to make them realize the value of good research and particularly of good record systems so that they will cooperate with epidemiologists and others who can see benefits from nonroutine use of material that lies within their administration.

For example, records of tuberculosis patients in Canada have been used to assess the risk of breast cancer associated with x-irradiation from multiple fluoroscopies. This has been done by following up large numbers of tuberculosis patients, identified through hospital records, which have also provided the necessary data on radiation exposure. This research is answering an important question at only a fraction of the cost of alternative approaches that would have been necessary if the existing records had not been used. Although this study was designed and carried out by epidemiologists, the administrators of the relevant hospitals provided essential support. Many such examples of useful cooperation can be found, but there are unfortunately other situations where important opportunities have been wasted through the lack of concern of administrators toward the potential information hidden in the record sources they control.

In summary, it is suggested that the health planner needs to know some epidemiological subject matter—the features of the occurrence and natural history of major diseases—and also needs to be aware of some of the methods used by epidemiologists that are applicable to the planning and evaluation of health care systems. Whether or not the course is called "epidemiology" or the teachers call themselves "epidemiologists" is immaterial. The knowledge must be transmitted.

The Contribution of Classical Epidemiology

Each program of health planning or health administration can probably group its epidemiology teachers according to three levels of sophistication. In many situations, such as our own at UBC, epidemiolo-

gists are available who can teach the subject, although in some cases their main interest is in areas other than health care studies. Below this, one might say, is the situation where people who are primarily epidemiologists are not available. Then it is necessary to extract the subject matter from clinicians, vital statisticians, demographers, and so on; and to obtain the methodology from statisticians, sociologists, and the like. This approach clearly needs some unification and synthesis, either by a hardworking faculty member or by the students themselves. There is a third level of sophistication, beyond that of the present UBC program. The subject of health care research or health care evaluation is rapidly developing in its own right. In the future, specialists in this area may be numerous enough to take over the teaching currently done by epidemiologists whose main interests are not in health care areas. However, the principles of this newer area are firmly based on epidemiology, and we have found that students seem to gain the necessary knowledge and attitudes even from classical, that is, disease-oriented, epidemiology courses, although a fully health services oriented curriculum is perhaps desirable. The examples discussed here are all, quite deliberately, taken from the area of classical epidemiology, and yet they convey important principles applicable to health care studies.

Those who teach epidemiology to health planners have a difficult task. The subject may appear to the students and to fellow faculty as somewhat outside the main theme of planning and administration, and yet it is of central importance. Although it may seem superficially simple (and therefore may be allocated little curriculum time), most students find epidemiology quite difficult, and few will retain much understanding unless they have actually worked with data and discussed the techniques involved at some length. Yet a sound basic training in the subject is essential. One must especially avoid the error of assuming that the future planners will be able to simply call in an epidemiologist when needed; there are very few trained epidemiologists relative to the needs of the subject.

Notes

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4. R.P. Gallagher and J.M. Elwood, *Cancer Mortality among Chinese, Japanese and Indians in British Columbia, 1964-1973,* National Cancer Institute Monograph, vol. 53 (Washington, D.C.: the Institute, 1979), pp. 89-94.

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8. G.Z. Brett, "The Value of Lung Cancer Detection by Six Monthly Chest Radiographs," *Thorax* 3 (1968): 414-20.

9. R.R. Neutra et al., "Effects of Fetal Monitoring on Neonatal Death Rates," *New England Journal of Medicine* 299 (1978): 324-26.

8 Integrating Epidemiology and Health Services Administration: A New Program at Yale University

John D. Thompson, Ph.D.*

The focus of Yale's new program is the relationship of epidemiology to health services administration (HSA). The crisis facing the American health care system highlights the necessity for professional epidemiologists and health service administrators to learn to work together. The changing nature of health and disease, the rising costs of care, the lack of coordination between facilities and services, the unnecessary duplication of expensive technical resources, the inequitable distribution of facilities and manpower, and the growing doubts about the quality and value of many preventive, therapeutic, and diagnostic services all serve to stimulate a reevaluation of our health care system. Epidemiological methods are well-suited for describing and evaluating the distribution of health-related characteristics and events, including outcomes among populations.

Although interest in the application of epidemiological techniques in health services administration is growing, the two fields, historically, have remained apart. According to the Report of the Commission on Education for Health Administration, some of the reasons for this separation are as follows:

- Epidemiology has a long history as a developed discipline, whereas health services administration is a relatively new field, and there is some debate about its status as a separate or derived discipline.[1]
- Traditionally, HSA has trained individuals for positions primarily in private health care settings, whereas epidemiology often has trained persons for positions in the public sector.
- Epidemiology is taught generally to physicians by other physicians, whereas HSA is usually taught to laypersons by nonphysicians.

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- Although epidemiology has broadened its perspective over time, historically it has focused on the occurrence of infectious disease and other illness patterns in large population groups, whereas HSA focused originally on the institutional level and only recently began to stress the importance of the community perspective.
- Until recently, health policy-makers have not been able or willing to consider the delivery of personal health services on a community or population basis.[2]

Academic Issues

"Epidemiology" may be defined operationally as a study of events that affect the health of populations. The underlying approach of epidemiology is to determine the relationship between cause (the event) and effect (changes in the health of the population). The method entails a careful delineation of the life history of the event and a meticulous definition of the population at risk if any causality may be validly tested or inferred.

Epidemiology provides the important investigative perspective in the study of health and disease: "the triumph . . . has been its utility in helping researchers trace out, step by step, interdependencies between the life ways of individuals and the appearance and non-appearance of disease in a population."[3]

Philosophical differences undoubtedly account for various definitions of the term "epidemiology," and the definition above includes both the basic research and the applied aspects of the science. Broad definition is important in order to cover the biological aspects of noncommunicable as well as communicable disease in populations, and also to include the environmental, social, and behavioral factors that play major roles in the health of populations.

Epidemiologists focus on a determination of who, in a particular population, develops a disease, on what occasions, and under what influences. Typically, the epidemiological approach is used to understand better the etiology of disease. Identifying disease causation and distribution factors in a population suggests various ideas that lead to more focused investigation. Further, the epidemiological method is used to explore specific hypotheses associated with socioeconomic and demographic characteristics, plus those associated with expectation systems, social attitudes, and other characteristics of persons and groups. The epidemiological focus, therefore, is not only on clinical samples, but on populations and samples of populations. Attention is directed to health as well as to disease in an attempt to determine and differentiate those factors and forces in populations that affect the onset

and progression of disease, those that influence the help-seeking process, and those that contribute to wellness.

The objectives of applied epidemiology are usually the prevention, containment, or eradication of the events resulting in a negative change in a population's health. To choose from among competing sub-objectives and between prevention, containment, or eradication, many positive and negative factors must be estimated. One factor must be the trade-offs between the monetary cost of the program and the savings to the population from that program. More attention, therefore, should be paid to the specific effect of intervention on the health of the population.[4]

Recently, epidemiologists have begun to evaluate the value of various types of intervention and the various returns on resource expenditures involved in those interventions.[5] Thus, epidemiology has now made a significant "contribution in quantitative approaches to the problems of allocating finite resources with the objective of improving the public's health."[6]

"Health administration," as defined by Stark, is "planning, organizing, controlling, coordinating, and evaluating the resources and procedures, by which needs and demands for health and medical care and a healthful environment are fulfilled, by the provision of specific services to individual clients, organizations, and communities."[7]

The multifaceted concerns of HSA, and the consequent skills and knowledge a health service administrator is expected to master, in areas of both health and administration, are reflected in the Commission on Education for Health Administration's broad definition quoted above. The organization and financing of health services in the United States have changed substantially in recent years. Distinctions that once were clear between the functions of public health departments, hospitals, ambulatory care facilities, and other community agencies are now blurred. Increased attention and concern over the accessibility to and costs of health care services also have generated new concerns in the health care field, including increased governmental and consumer activity, health services monitoring, and health planning.

Changes occurring in the health industry reflect a fundamental shift in social philosophy. The principle that high-quality health care at reasonable cost should become available to all is becoming accepted. This belief has led to the development of integrated, comprehensive health care organizations for an identified population, coupled with broader insurance protection for health services generally. Playing an increasingly important role in achieving better performance are the health services administrators, planners, evaluators, and policy analysts who work for both public and private organizations and for agencies con-

cerned with more general social policies. These individuals, necessarily, must have a broad base of knowledge and skills in areas encompassing health, health service, and administration.

At Yale, we are building on the previously disparate content offered in epidemiology and health service administration to meld the two areas into a single program. Epidemiology and health services administration are defined as that body of knowledge that a professionally prepared practitioner should possess in order to carry out the planning, controlling, coordinating, and evaluating functions in health services administration through the application of the basic science of epidemiology, which enables the practitioner to view the above functions in light of a defined population at risk. The population may be geographically defined as members of a community, region, state, or nation.

Academic Goals of the New Program

The academic goals of the program reflect those of both the Division of Health Services Administration and the Division of Epidemiology. The goals of the Division of Health Services Administration are the following:

- To supply a basic foundation of knowledge in public health, including epidemiology, biometry, administrative sciences, and the social sciences as they relate to health services.
- To teach concepts, principles, and scientific skills fundamental to the planning, organization, administration, and evaluation of health services in this and other countries.
- To develop an understanding of health services as interrelated components of overall community resources.
- To emphasize the importance of research in investigating and developing health services.
- To equip students to view the responsibilities of the administration and organization of effective health services in broad ecological terms and thus be able to anticipate future health service needs in relation to available technology, existing institutions, and the needs and demands of society.

The Division of Epidemiology aims to teach the epidemiological approach in a course called "Epidemiology of Non-Infectious Disease," which has as its goal the development of a sufficient degree of research skills to enable students to contribute to

- Knowledge of the epidemiology of chronic disease, and

- An awareness of the social actions (public health programs) that should be undertaken to further their control.

In addition, three new courses have been mounted dealing directly with the application of epidemiological principles to health services administration, including a final integrative course in which case studies were developed to demonstrate the policy issues and management implications of the joint area.

Students are expected to learn basic epidemiological and biometric principles with special emphasis on the effects of intervention on populations and the relationship between incidence and/or prevalence of diseases and programs specifically designed to prevent, contain, or eradicate them.

Although the curriculum is being structured and designed to include the basic required courses for both majors, opportunities for additional electives in epidemiology, biometry, or health service administration will be made available. The research emphasis now so characteristic of educational programs in epidemiology and in health service administration at Yale University will be broadened as the basic underpinning of the second year.

General Goals of the New Program

The overall program in epidemiology and health services administration has three general goals. The first is to contribute to the improvement of health service planning, evaluation, and control through the provision of professional training at the graduate level for students whose careers are committed to the boundary areas between epidemiology and health care administration.

Graduates of this program will seek employment in a wide variety of health agencies, in particular in Health Systems Agencies under P.L. 93-641 at both the local and state levels; in Professional Standards Review Organizations (PSROs); in health insurance and prepaid health care programs; and as research assistants and associates in a wide variety of evaluative efforts in the fields of health care planning and management. The main applied proficiency areas envisioned for these graduates is in health planning, program evaluation, and those aspects of management concerned with the design and implementation of systems that monitor both quality and cost control.

The second goal is to undertake and disseminate findings of research and development (including the specific cases developed in the course) to both the academic and practice arenas involved in epidemiology and health services administration. The third goal is to provide consultation and technical assistance to organizations, agencies, and institutions now

engaged in the three functional areas. Since the area is new, and as yet poorly defined, we anticipate raising research and contract monies to supplement the academic program.

This program capitalizes on the organization of the School of Public Health at Yale in that it envisions a close coordination of three of its divisions—epidemiology, biometry, and health services administration—and has as its goals unifying, integrating, and focusing the three major components of the school on selected functional aspects of health services administration, that is, planning, evaluating, and monitoring. As such, it fits comfortably within the loosely defined sub-specialty areas of the Division of Health Services Administration—such as long-term care administration, hospital administration, mental health administration, public health administration, and health planning—and has relevance to each of these areas. In addition, such an approach, which in essence is a selected mix of classes within specialty clusters, offers a new dimension to other health services courses in such fields as public policy, health education and self-help, and the management sciences.

The mission of the School of Public Health (Department of Epidemiology and Public Health, Yale University School of Medicine) is based on an integration of the four major sections of the department:

- Epidemiology as its basic science.
- Biometry as the quantitative application of that science.
- Health services administration as the application in an organized setting through some form of organized social effort of that knowledge derived from the basic public health sciences of epidemiology and biometry as well as from medicine.
- Environmental health as the application also through organized social effort and knowledge based on epidemiology, biometry, and health services administration in addition to engineering, toxicology, and environmental physiology and psychophysics.

All four divisions have as their goal the improvement of the health of describable populations.

The long-range plan for the School of Public Health, and in particular the Division of Health Services Administration, is to broaden its concern in the general field of public health by including new disciplines, such as medical economics, organization behavior, and demography, in the basic teaching-training program. More important is the reinstitutionalization of the original purpose of the School of Public Health, that is, to provide services to health programs in the state of Connecticut. The school has been moving in this direction for the past several years as the result of introducing another special program in

which students in the second semester, along with faculty advisers and agency preceptors from the community, engage in a wide variety of studies for diverse agencies, primarily within the state. All sections of the school—the Divisions of Epidemiology, Biometry, and Health Services Administration—are combined into teams that study selected problem areas. This approach has borne fruit in that it has made the state and region much more aware of the school, has kept the faculty and students aware of present problems in the health field within the state, and has brought the four sections of the department more closely together in evaluating the real problems in the communities. Evaluations of the five years' accomplishments have been reported to the Bureau of Health Manpower. Thus far, evaluations have indicated that this new approach has succeeded in introducing new material and methods into the curriculum and obtaining their acceptance from the total faculty of the department, which has been concerned about integration of this program with all other programs offered.

The long-range plan is consistent with the school's mission in that training new entrants in a field as diverse as that of public health today requires a multidisciplinary approach. If one is to carry out meaningful education and research in this broad area, one must forever reinforce new knowledge from within and without the school, directed toward the application of these disciplines, while maintaining firm anchors in the communities in which these problems arise. The program in epidemiology and health services administration is consistent with, and is a further development of, the five-year plan for the school and its implementation.

Notes

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5. A.L. Cochrane, *Effectiveness and Efficiency: Random Reflections on Health Services* (London: Oxford University Press for Nuffield Provincial Hospitals Trust, 1972).

6. K.L. White and M.M. Henderson, eds., *Epidemiology as a Fundamental Science* (New York: Oxford University Press, 1976), p. 67.

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9 A Framework for Teaching Epidemiology in Health Administration Programs

Virginia Drone Hennelly, Ph.D.*

The purpose of this chapter is to present an approach to introducing epidemiology into the course sequence in a health administration and planning program. This approach represents one program's method of integrating this subject matter, and as such may be helpful to other educators considering including it in their curriculums.

Courses covering the principles of epidemiology only recently have begun to find their way into health administration curriculums. This trend is a positive sign indicating that programs are being broadened to meet the challenges facing administrators today. Developments in the past 15 years have enhanced the need for and value of epidemiological precepts as administrative tools. During this period, major federal health care legislation has steadily shifted control of health delivery institutions from internal management to external regulatory bodies. For example, health systems agencies (HSAs) have been incorporated to ensure availability, acceptability, continuity, and quality of health services within a region. In addition, certificate of need (CON) legislation requires that health care institutions document the need and cost-effectiveness of desired capital expansion.

The administrator's ability to accomplish this documentation presupposes an understanding of the region's priorities as well as the needs of the population concerned. It is in this respect that courses in epidemiology constitute a valuable addition to the health care administration curriculum. These courses give students tools for measuring and evaluating patterns of illness and disease within a specified population. The aim of these courses is to demonstrate to future administrators the importance of these methods in documenting need for new services, in judging the effectiveness of current programs, and in setting priorities responsive to the needs of the population served.

Course content, however, should encompass more than traditional epidemiology. It should provide a conceptual framework that combines

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epidemiological principles with introductions to systems analysis, medical sociology, economics, biostatistics, and research methods. In this way, the various concepts related to the study of populations can be emphasized. The product of this process, then, is an integrated approach to the study of quantitative methods useful in assessing and analyzing need within an institution's population or service area.

Systems analysis provides a macro-level look at the interrelationships between agencies and organizations, as well as the impact of the political, social, and economic environments. Since the population can be viewed as the input to the system, critical weaknesses in the process of providing health services can be highlighted in the network. Furthermore, the study of the health care "system" can indicate what to emphasize in order to achieve desired outcomes such as better health levels, greater accessibility, and cost reduction.

Medical sociological concepts are important components of the course content because they provide definitions for key terms. Administrators must understand the differences, as well as the similarities, in the meanings of "illness," "disease," and "health." Of equal importance is the notion that no clear-cut distinctions exist between well-being and sickness. Therefore, to determine the need for health care within a population, the future administrator must be aware of the difficulties in classifying patients or in placing them along the health-illness continuum.

Basic economic principles are the third major segment of this eclectic approach to studying health care and population. Cost-benefit analysis gives students a way to measure the outcome of investments. By comparing various programs using this technique, future administrators can learn how to allocate scarce resources efficiently.

Also included in the course framework is an introduction to biostatistical techniques. Although the administrator seldom uses these methods directly, they are the means by which epidemiological statements can be made. Analyses based on probability samples can provide valid and reliable statistical inferences about the population. Administrators, therefore, need a solid introduction to sampling methods, inferential statistics, and multivariate analysis. Furthermore, to understand the significance and limitation of test results, they must know how to compute, standardize, and evaluate the various rates used in epidemiology.

Methods of research also contribute to the paradigm. Administrators who understand both the necessity and the suitability of the various data-gathering techniques are better able to evaluate the results of epidemiological studies. Included here are introductions to experimen-

tal and quasi-experimental designs, case control methods, and survey techniques.

The final element in this framework encompasses traditional epidemiological principles. Students need a firm grasp of concepts such as population at risk, prevalence, incidence, morbidity, mortality, and relative and attributable risk. Furthermore, knowledge of the web of causality brings the course full circle by demonstrating to students that, like the larger health care marketplace, health and disease may be viewed as systems.

These various fields can be meshed into a meaningful totality for students by requiring research papers on various diseases prevalent in our culture. Areas such as cancer, heart disease, traffic accidents, diabetes mellitus, alcoholism, drug abuse, and mental illness can be the subject of intense investigation into the web of causality, prevalence, incidence, mortality, cost of care, and impact on the resources of the health care system. Library research of this type can be a valuable tool in making epidemiological principles meaningful to students.

This course outline does not assume that the subject material be taught in any specific manner. Rather, it recommends only that these various areas should somehow be integrated into one framework. Actual courses may range from a one-term introduction or overview to a detailed analysis covering several semesters. The key notion is that future administrators must realize that their decisions will affect other institutions, that their programs must be defensible to many audiences, and that their goals must be responsive to the needs of the population.

10 An Epidemiologic Perspective for Managers

K. Michael Peddecord, Dr.P.H.*

A wise epidemiologist once remarked to his class that few would ever be epidemiologists but that every health service professional could use epidemiology in everyday practice.[1] With this remark to set the tone, a course in the epidemiology of medical care is required of students in the graduate program in hospital and health services administration of the University of Health Sciences/Chicago Medical School (UHS/CMS).

Program Setting and Philosophy

The program in health administration began instruction during the fall quarter of 1977.[2] The UHS/CMS program is unusual in that it is specifically designed to meet the graduate education needs of health and human service professionals who intend to enter (or who already hold) line or middle-management positions. The majority of both full- and part-time students are nurses and other allied health professionals.

Epidemiology is a course in the health environment sequence. Examples of other courses in this category include health economics, health law, health care organization and policy, and current issues in health care. The purpose of this instruction track is to develop and expand the students' perspective on relevant health and medical care questions. Epidemiology is also intended to follow biostatistics and precede the research design courses in the qualitative management sequence. Completion of this course should provide students with the basic knowledge and many of the skills required for their problem-oriented major projects. Epidemiology is particularly relevant since major projects often require students to take a community or cross-sectional perspective in order to address health service problems presented during this major project.

The university faculty believes that analytical and information development (applied research) skills are essential to all health services administrators. These skills may be particularly lacking among mid-level managers, who are primarily nurses and other allied health

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professionals. Most of these individuals assume supervisory positions as a result of professional competence and seniority rather than management skills or education. Most come from environments where undergraduate training and education provide limited opportunities to develop those skills. Without graduate education and analytical and information development skills, those individuals have traditionally been limited in their ability to gather and analyze information methodologically. Internal capabilities to engage in applied problem-solving research can be greatly expanded if administrators with allied health backgrounds are versed in essential analytic and information development skills.

Thus, with the inclusion of epidemiology and other health environment and quantitative skills courses, this program is consonant with the philosophy of the university. Allied health professionals have not routinely been involved in expansion of professional knowledge. Such lack of direct involvement in formulation and initiation of research seriously limits professional development of the various nursing and allied health disciplines. It is our belief that nurses and allied health professionals, who are experienced with the complexities and technology of health care delivery and also have graduate education, are ideally suited to contribute to research that evaluates and improves activities of their professions. Epidemiology can be an essential tool in solving operational problems and expanding professional knowledge.

Definition of Epidemiology and Course Scope

A definition of epidemiology in a health services administration curriculum must be broad and inclusive. A most workable definition is Stallones': "Epidemiology is the description and explanation of the differences in occurrence of events of medical concern in sub-groups of population, where the population has been subdivided according to some characteristic believed to influence the occurrence of the event."[3] Obviously, an "event of medical concern" can be rather inclusive. Students are encouraged to define common events of interest to administrators in epidemiologic terms. Common health services management events include productivity, use of resources, employee turnover, and employee morale, as well as more traditional nosocomial infection rates and the health status of the service community.

A general goal of the epidemiology course (similar to the goals of all courses in the health environment series) is to develop the philosophical perspective and the alternative-seeking and questioning attitude required of all administrators. Specific course objectives for epidemiology of health care include the following:

- Understanding of basic principles of disease, causation, and the epidemiologic model, its components and underlying principles.
- Understanding of and ability to use basic descriptive and analytical epidemiologic techniques.
- Ability to identify communities and articulate methods of measuring events of medical interest.
- Ability to differentiate the types of epidemiologic studies and recognize the advantages and disadvantages of each.
- Ability to read critically and understand medical and health care administration literature and to recognize fundamental fallacies in design and numerical reasoning.

The use of epidemiologic techniques are similar to those suggested by Morris[4] as well as other examples presented in *Epidemiology as a Fundamental Science.*[5] With this relevance and varied utility established, students readily accept the course as a useful curriculum requirement.

Course Content and Requirements

Since epidemiology is highly eclectic and provides a large fund of knowledge, the course-design problem for this instructor has been one of selection and emphasis. The initial course has been centered around an exercise series in epidemiology.[6] Didactic sessions seek to emphasize relevant points and present additional examples from administrative and health services research literature.

A term paper consisting of a brief epidemiologic research prospectus chosen by the individual student is required. Students must articulate a study population, specify an event of medical interest, and identify potential data sources, analytic techniques, problems, and limitations. Student topic choices have tended to be pragmatic, with students picking problems from several local hospitals and health agencies. Topics have included nosocomial infections, demand estimates for laboratory services, career patterns among radiological technologists, evaluation of a diabetic patient education program, market potential for a hospice, and provider attitudes toward "surgicenters."

Text selection presented a problem. Friedman[7] was the text initially chosen along with chapters from Susser[8] and selected reprint readings. Lilienfeld's text[9] is planned for use next year. It is hoped that future texts will be more applicable in the administrative area. Heavier supplementation from *Epidemiology as a Fundamental Science*[10] and *Applied Health Service Research*[11] as well as health services research literature is planned for subsequent courses.

Course Evaluation and Conclusion

Because this is the initial course offering, course evaluation is incomplete. Student critique on an ongoing basis has been sought. Long-range plans include a task analysis and evaluation by graduates of the epidemiology course, as well as other UHS/CMS courses. Student, graduate, and employer feedback will, it is hoped, enhance the content of this course.

Just as few epidemiology students will become epidemiologists, relatively few graduates of health services administration programs will become hospital chief executive officers (CEOs). Although the CEO's position would seem to be ideally suited to an epidemiologic perspective, an understanding of this perspective and its techniques can serve all line supervisors and staff members who must often function on the CEO's behalf. Regardless of whether we call it a management, marketing, or epidemiologic perspective, this community orientation is essential to health service administrators. Recent events such as the Health Planning and Resources Development Act of 1974, PSRO's, utilization review, and cost containment are clear indications that administrators must be concerned not only with the efficiency of their production processes but with the effectiveness of their organizations in terms of community service and health status improvements. A knowledge of epidemiology, obtained during formal instruction, should serve all administrators in the demanding and challenging health services environment of the future.

Notes

1. Remarks of Reuel A. Stallones, M.D., M.P.H., to an introductory class in epidemiology, University of Texas School of Public Health, spring 1975.

2. The UHS/CMS program is an associate member of the Association of University Programs in Health Administration. The first class entered in the fall quarter of 1977.

3. Epidemiology Exercise Series, University of Texas School of Public Health, Houston, Tex., 1977. Exercise 1: Introduction to Epidemiology, p. 4.

4. J.N. Morris, *Uses of Epidemiology* (London: E.S. Livingstone, 1970).

5. K.L. White and M.M. Henderson, eds., *Epidemiology as a Fundamental Science: Its Uses in Health Services Planning, Administration, and Evaluation* (New York: Oxford University Press, 1976).

6. The University of Texas School of Public Health Exercise Series in Epidemiology, developed by the faculty, is intended for use in the initial course for master of public health students. This exercise series is "classical" disease-oriented epidemiology. Revision is in progress and will include more health services and hospital-oriented "management" problems. Ultimately, it may be possible to have two exercise tracts, one in "classical" epidemiology and a second in "administrative" epidemiology. Students could then choose the series which best meets their needs and interests.

7. G.D. Friedman, *Primer of Epidemiology* (New York: McGraw-Hill, 1974).

8. M. Susser, *Causal Thinking in Health Sciences: Concepts and Strategies in Epidemiology* (New York and London: Oxford University Press, 1973).

9. A.M. Lilienfeld, *Foundations of Epidemiology* (New York and London: Oxford University Press, 1973).

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III. Descriptions of Three New Courses

11 The Marketing-Epidemiology Interface

Roberta N. Clarke, Ph.D.*

This chapter addresses an interesting problem: the interface between epidemiology and marketing. The author, like most marketers, is not trained in epidemiology. On the other hand, most epidemiologists have no knowledge of marketing. This would appear to suggest that marketers and epidemiologists have very little in common. However, since marketing performs many of the same tasks that epidemiology performs, it is suggested that an interface only seems to be lacking between the two fields. Unfortunately, the similarity between their functions is obscured because they use different vocabularies. Many fields, similar in purpose and thought, find themselves artificially separated by dissimilar vocabularies. This results in unnecessary communication gaps between fields that could mutually profit from the exchange of ideas and concepts were they to share a common vocabulary.

The Common Ground

Let us look at a well-known epidemiologist, Kerr White, to see what terminology he uses and what issues he addresses; let us also then translate his words into marketing terminology. Specifically, in "Opportunities and Needs for Epidemiology and Health Statistics in the United States,"[1] Dr. White puts forth a series of questions that epidemiologists—or those administrators making epidemiological-based decisions—should be asking. We find that health care marketers ask the same questions, except that they use a different vocabulary.

For example, Dr. White asks, "What is the aim of the procedure in question?" Marketers would ask, "What is the objective of this effort? What is the attitude or behavior which is sought?" Dr. White asks, "How many people, and what kinds, are potentially eligible for help from these procedures?" "How can this market be segmented?" Dr. White continues, "What kinds of people are they?" Marketers, seeking to

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answer this question, would examine the variety of ways to segment the market: demographically, psychographically, and in terms of usage, volume, and benefit segments.

The epidemiologist asks, "Does the procedure do any good?" The marketer instead addresses this issue by asking, "What are tangible measures of our objectives?" The marketer then seeks feedback on the attainment of these objectives. And finally, Dr. White evaluates public perception of the procedure or service; marketing tries to find answers to similar questions through consumer research.

Marketers and epidemiologists also develop many of the same research skills. Like epidemiologists, market researchers develop skills in sample selection and work to eliminate experimental bias; they set up research controls and standardized procedures. They use confidence limits and, in some research, randomized clinical trials. The research techniques may have different names but they are essentially the same.

Thus, it is clear that the fields of marketing and epidemiology share sufficient common ground that they might profit from exploring each other's territory. Indeed, there is an interface between the two fields. The reason that this has not been recognized in the past appears to be a function of the antibusiness (and more specifically the antimarketing) bias prevalent in the health care field. However, if this bias can be overcome, then the values of a cross-field exchange could be realized.

Use of Marketing Principles in Health Education

Having established that there is substantial overlap between marketing and epidemiology, it is also the case that marketing performs many functions related to epidemiology but with which epidemiology does not concern itself. These functions are traditionally not in the epidemiologist's area of expertise but rather in the health educator's area.

Epidemiologists discover disease patterns, presumably so that action can be taken to prevent further disease. This action usually takes the form of behavior change by some part of the health care or public health system, or by the public. The epidemiological findings leading to these actions, however, are handed off to health educators—and to the various health education arms in government—to be implemented. Epidemiologists do not traditionally take it upon themselves to translate their findings into actions resulting in better public health. This is not part of their training, nor are most epidemiologists inclined to become involved in this aspect of public health. Therefore, they would probably not be effective were they to assume this responsibility. Instead, the problem lies in the fact that the health educators, who do assume the

responsibility of implementing public health actions resulting from epidemiological findings, are also often ineffective. Two health educators have briefly examined a variety of areas in which health education campaigns have met with an unfortunate lack of success:

> We appear to be gaining little ground on several health fronts. Although many adults, for example, have stopped smoking, overall cigarette consumption is greater in the 1970s than ever before in spite of the abundance of scientific evidence as to its potential harm . . . adolescents and adults continue puffing away against the strong advice of the medical and health professions. . . . Numerous studies document the increase in teenage pregnancies. . . . Obesity is harmful, yet too many Americans appear to be overweight. . . . Physical activity is generally regarded as an adjunct to healthful living, and still the majority of Americans continue to behave in a sedentry fashion and devote little time to regular periods of physical exercise. . . . Seat belts in automobiles are known to reduce the incidence of fatal accidents, . . . yet thousands of Americans die annually from failure to use them.[2]

Another example of the questionable effectiveness of traditional health education efforts in the United States is the alarming trend of increasing numbers of children who have not been inoculated against childhood diseases.[3] Other epidemiological findings that appear not to have been adequately translated into public health behavior are related to the need for sufficient exercise; the need to decrease sugar and empty calorie consumption; and the need for screening and early diagnosis in areas such as hypertension, breast cancer, and diabetes.

The application of marketing principles to these health education campaigns could help health education to be much more effective. While public health campaigns in the past have sometimes been labeled ineffective in persuading people to do what they should do, marketing has often been accused of being highly effective in persuading people to do (to make purchases) what they do not even want to do. If marketing were thus to be applied to health education, it should be possible to be highly effective in persuading people to do what they "should" do (i.e., to take actions resulting in better health). While both claims—that health education is ineffective and that marketing is too effective—are in need of qualification, a marketing framework for public health campaigns is likely to result in greater success in achieving the goals of health education.

Basic marketing management offers a variety of tools, such as market research, market segmentation, benefit analysis, promotional analysis, and positioning, that will be useful in developing health edu-

cation campaigns. Beyond the tools of marketing, the field offers an orientation that runs counter to traditional health education but is necessary and basic to good health marketing. This is a consumer or market orientation, which assumes as a primary objective the need to recognize and address the wishes of the consumer.

Marketing versus Moralistic Orientation

Marketing's consumer orientation conflicts with the traditional moralistic orientation of the health education field. The traditionally moralistic component in health education is not difficult to establish. In discussing how the health education field began to formalize its objectives, Crase and Hamrick pointed out:

> Perhaps the first significant determination of educational objectives embracing health instruction occurred in 1918 when the National Education Association selected health as one of seven major objectives of education (along with) command of fundamental processes, worthy home membership, vocation, citizenship, worthy use of leisure and ethical character.[4]

The concept of health as a moral responsibility of the individual is further addressed by Crawford, who quotes Robert Whalen, former commissioner of the New York Department of Health, and John Knowles, head of the Rockefeller Foundation, using such phrases as "unless we assume the individual and moral responsibility for our own health" and "I would lean much more in the direction, once traditional, of saying that health is a duty, that one has an obligation to preserve one's own good health."[5] Sheffield holds up as a model of health education a set of health education programs run by a church-operated hospital. These programs base themselves on the premise that the healthy life is the religiously acceptable one.[6] Clearly, here also, good moral behavior translates into good health behavior.

Therefore, it is not surprising that the basic sense one pulls out of many health education campaigns is a moral one: one should exercise; one should eat three meals a day; one should not overeat, smoke, or drink alcohol. We have heard many times a variety of "shoulds" and "should nots," accompanied by an imaginary finger waving at us and reprimanding us for our previous bad behavior. Anne Somers, a leader in the field of health education, recognizes, although not happily, this behavior among "professionals who sometimes berate the public for failure to follow a prudent lifestyle" and for "behavior formerly considered anti-social as well as immoral."[7] Clearly, chastisement and an exhortation to better our future behavior has not constituted effective health education. The statements that one "should" undertake certain

actions have not provided sufficient motivation to bring about the desired behavior changes.

Health education based on marketing principles would be nonmoralistic and consumer oriented. Rather than dictating what behavior should be followed in order to maintain or improve health, marketing principles would lead one to do consumer behavior research. Such research would determine the consumer needs that must be met in order to make the consumer receptive to the health education message. For example, one might examine the group showing the greatest increase in smoking: teenage girls. A traditional approach, which essentially says, "Don't smoke," or, "You shouldn't smoke because it's bad for you," is likely to backfire. Studies have shown that teenage girls who smoke do so partly out of rebellion. Any attempt to exert authority over them is likely to be thwarted; that is, the teenage girls will probably choose to do just what you tell them not to do: smoke.

However, marketing-based consumer research would be very likely to turn up a strong need in most adolescent girls to be attractive and sexy. It is through this consumer need that an antismoking campaign might address itself effectively by conveying the fact that smoking yellows teeth and causes bad breath. Neither yellow teeth nor bad breath is attractive or sexy. This is a communication that teenagers can understand and to which they can immediately relate. The threat of ill health some 30 years hence (even 10 years hence) is meaningless to most teenagers, whose needs and wants tend to be focused on their desire to be attractive today.

Thus, in summary, health education must drop its normative orientation if it is to be effective. Marketers learned long ago in the business world that one cannot give people something they do not want. On the other hand, it is possible to persuade people that they want something if they perceive that it satisfies their needs. Health education, then, must address itself to people's needs.

It should be noted that in some instances improved public health behavior can be effectively solicited without appealing to the needs of the market. This is when the behavior can, in essence, be mandated. Such was the case in 1978 when one U.S. city, on discovering that a substantial proportion of its entering schoolchildren had not yet been inoculated, decreed that no child would be allowed to enter school without proof of inoculation. Since all children must by law attend school, all children had to be inoculated. Thus, the behavior, which epidemiological findings have indicated is necessary, was achieved without appealing to consumer needs but instead by regulatory action.

However, the instances where public health behavior can be

effectively mandated are rare. Could we, for example, decree that all able people must exercise at least three times a week? Would the government be willing to ban cigarettes in order to succeed in their antismoking effort? The answer to these and similar questions is very probably negative. Therefore, in the absence of the power to mandate behavior, we must solicit the desired health behavior by appealing to consumer needs.

Do Consumers Want Health Information?

Health education has, to a large extent, been responsible for providing health information. "Health education, as a planned, organized activity, started out as an information-giving service—attempts to reach large numbers of people with factual information about health and disease."[8] Even the name that some health educators apply to the task, "health instruction," underlines the way they define their task.

However, doubts are beginning to be raised about the efficacy of this approach: "Are we now addressing relevant issues through health instruction, and if so, how effective are we? The health educator continues to have difficulty in transmitting knowledge in such a way as to modify behavior significantly."[9]

While health educators include such activities as community organization and lifestyle change in a broad definition of health education, traditional health education activity appears to be characterized by the simple provision of information. Epidemiologists have tended to produce second, third, fourth, and follow-up studies; that is, more information, ad nauseam, when the results of a clean epidemiological study reported to the public have not produced a change in the relevant public behavior.

Consider smoking behavior. How many epidemiological studies have been performed with results showing clear links between smoking and various diseases? Needless to say, there have been many such studies over a number of years. Yet people—including physicians, health educators, and epidemiologists themselves, all capable of understanding the implications of the studies' results—continue to smoke. How likely is it that publicizing the results of one more study (or many more studies) linking smoking to lung cancer and heart disease will bring about the desired nonsmoking behavior? It is not very likely, since past reports of similar epidemiological findings did not cause the cessation of smoking. Future studies, while producing new statistics, are essentially producing old information—smoking causes disease—yet approximately 45 percent of the population smokes.

The same phenomenon has been found in the provision of health-related nutrition information. Two studies[10,11] found that the majority of consumers, when provided with nutrition information, were sufficiently passive or unmotivated that they failed to read the information provided, let alone change their behavior in accordance with it.

Clearly, the provision of raw information does not result in behavior change. Returning to the marketing principle of meeting consumer needs, we may say that if the information provided is not what the consumer wants to hear, then the consumer will reject it. At the very least, the consumer will reject that aspect that is uncomfortable to consider. Thus, Fishbein's antismoking study[12] found that the majority of smokers, while agreeing that a link exists between smoking and disease, rejected the possibility that their own smoking behavior was harmful to them. That is, smokers refused to personalize the dangers of smoking to themselves; they had rejected one part of the information as not being relevant to their own behavior.

Numerous studies reestablishing and reiterating the existence of this smoking-disease link could follow and receive much publicity through the efforts of the traditional health education network. Yet the provision of this new information, which essentially would be old information, would be rejected in the manner that past information was rejected by those consumers who did not want to hear it. This brings us back again to the marketing principle that you cannot give people something they do not want. Successful health education will require us to determine what relevant consumers (that is, consumers at risk) do want and then to link the desired health behavior to the consumer want.

Summary

The latter portion of this discussion may seem somewhat far afield of the focus of epidemiology. However, epidemiologists should be highly concerned with the issues addressed because the underlying issue concerns the effectiveness of epidemiology. If the findings of epidemiological studies cannot be effectively translated into better public health, then the question is raised: Why bother to perform epidemiological studies characterized by results that cannot be used? At what point should epidemiologists begin to concern themselves with the effects of their studies on public health? And if there is little or no effect, should epidemiologists start looking to fields that can provide the expertise that will effectively translate epidemiological findings into better public health?

This is where marketing not only interfaces with epidemiology, but, to a greater extent, complements it. As the first part of this chapter

indicated, marketers can fully understand and appreciate the work of epidemiology, since marketing performs many of the same functions under the guise of a different vocabulary. In addition, marketing extends itself into the field of health education. By using the same marketing principles that have so effectively been used in the for-profit environment, marketing can carry epidemiological results to the public in the form of better public health.

Notes

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3. Herbert Black, "Further Drop Feared in Polio Vaccinations," *Boston Evening Globe*, 4 August 1977.

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5. Robert Crawford, "You Are Dangerous to Your Health: The Ideology and Politics of Victim Blaming," *International Journal of Health Services* 7, no. 4 (1977).

6. Robert Sheffield, "Community Health Education: Beyond Fad to Commitment," *Hospitals*, 1 September 1977.

7. Anne R. Somers, "Consumer Health Education: Where are We? Where are We Going?" *Canadian Journal of Public Health*, September/October 1977.

8. Paul R. Mico and Helen S. Ross, *Health Education and Behavioral Science* (Oakland, Calif.: Third Party Associates, Inc., 1975).

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10. Mary Butler Bush and Jean Henderson Sabry, "Consumer Acceptance of Mailed Nutrition and Health Information," *Canadian Journal of Public Health*, July/August 1977.

11. Jon B. Freiden, "Consumer Reaction to Nutritional Labeling: An Indirect Approach," (Tallahassee, Fla.: Working paper 78-006, Florida State University).

12. Martin Fishbein, "Consumer Beliefs and Behavior with Respect to Cigarette Smoking: A Critical Analysis of the Public Literature" (Report prepared for the Federal Trade Commission, May 1977).

12 The Integration of Decision Analysis and Epidemiology in the Education of Health Administrators

Rebecca Fuhrer, Ph.D.*

The purpose of this chapter is to discuss the value and method of integrating decision analysis and epidemiology in the education of health administrators. A basic assumption underlying this proposition is that better health care, potentially resulting in better health, will be provided to the community if administrators use an epidemiological approach in analyzing their decision problems.

Health administration students are often exposed to epidemiological concepts and analytic decision models but rarely are taught to define and resolve problems in a way that integrates the formal reasoning of both. Therefore, these future health administrators are likely to misuse decision models by failing to structure them in a way that takes into account the epidemiological issues surrounding the problem. Both epidemiology and decision analysis are included in the education of health administrators to enhance reasoning strengths and teach specific techniques. A better merger of these important educational areas would more often enable health administrators effectively to apply what they have learned.

Teaching Decision Analytic Concepts

Making decisions is a major administrative responsibility. Hence, it follows that an important objective in educating health administrators is to introduce them to the analytical tools and other knowledge that can assist them in making intelligent decisions. In general, they are called upon to make decisions that could be classified as follows:

- *Operational or technical decisions* are those that occur routinely in resolving the way specific functions will be performed. These decisions are concerned with improving the efficiency of program activities and make use of information about the scope of activities, quality, and costs, given stated objectives.

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- *Management control or tactical decisions* usually result in setting priorities on objectives, allocating resources to determined objectives, and identifying ways of achieving those objectives. When facing decisions of this type, the administrator is concerned with the impact of the program in question on both the problem and its environment, the degree of impact, and the possible alternatives to existing organizational programs that can meet the objectives. Information on program effectiveness is important for these decisions.
- *Strategic decisions* bring about the establishment, confirmation, or transformation of policy and objectives. Planning is usually a strategic decision process. For strategic decisions, the administrator is concerned with whether the organization is doing what it should be doing, whether it should be doing it in a different way, or whether it should be doing something else.[1] The administrator needs information that permits the assessment of the organization's objectives.

A complete decision-making structure is necessary to make any of these decisions. Such a structure would entail the following stages:

1. Examine the situation.
2. Generate and compare alternatives.
3. Set priorities or values on potential outcomes.
4. Understand the probabilistic nature associated with outcomes.
5. Make the decision choice.
6. Carry out the decision.
7. Evaluate the results of the decision.[2]

Decision analysis is a method of making stages 1 through 5 explicit, thereby increasing the chances of making a good decision. Decision making involves taking risks; it means forgoing alternatives. The decision analysis model is useful in teaching the student to describe and analyze the decision-making problem.

Presumably, a decision is made when a situation is perceived as having an evident or possible problem necessitating investigation. The decision-maker needs information about the available alternatives or actions, including the possible outcomes of each action, as well as information about the existing situation. If administrators have no information, an unlikely situation, then they would be making a decision under total uncertainty. With better information, the underlying logical relationships of the decision problem can be better understood, and

uncertainty about uncontrollable events and situations which nonetheless influence the final goals, can be decreased.

Epidemiology and the Epidemiological Approach as an Information Source

To resolve the decision problem, the facts about the present situation and the objectives, hence the alternatives, need to be analytical and not just descriptive. Epidemiology and epidemiologic methods can assist by providing needed knowledge and information. The health administration student needs to gain an understanding of epidemiologic knowledge, with an appreciation of the problems that can be resolved by an epidemiologic investigation, as well as the problems that epidemiology cannot resolve because the field is either theoretically underdeveloped or has no application.

Although other definitions have been proposed, a broad definition will be used in this paper. Epidemiology is often parsimoniously defined as the "science of the occurrence of disease."[3] A preferable definition considers epidemiology to be the science of the distribution and determinants of disease and disability in human populations over time, and this includes the study of the medical needs of society.[4] This definition is complemented by a conclusion of a World Health Organization (WHO) symposium, which asserted that epidemiological studies serve three main purposes:

- To reveal the etiology of disease and ill health, hence permitting the control or modification of illness.
- To guide the development of health services by defining the size and distribution of ill health in the community.
- To provide methods of measuring the effectiveness of medical services.[5]

Administrators can use the results of such epidemiological studies to learn about community health problems. They can then analyze the resources being used to meet those needs and their level of effectiveness. Alternative health care interventions—curative or preventive—and their estimated levels of effectiveness at meeting or altering the health needs in the community can then be ascertained. Health administrators would thereby be far more prescriptive than reactive in ministering to the organizational and programmatic needs of the community they are serving.

John Cassel has suggested six ways in which epidemiological data can be used:[6]

1. To show the magnitude and extent of the health problem, in terms of current estimates and trends.

2. To identify the population groups at highest risk.

3. To elucidate risk factors, i.e., those environmental and/or behavioral factors that need modification either through the personal health services or through social or political action if the health problem is to be improved.

4. To assess the status of current attempts to alleviate or cope with the problem, both in terms of utilization patterns of existing services and in terms of the impact (effectiveness and efficiency) of the service or procedure.

5. To facilitate the long-term monitoring of the health consequences of political decisions or changes in the delivery of health services.

6. To provide for the surveillance of environmental and behavioral changes to determine their potential health consequences.

The importance and value of this information resource cannot be overstated and have been nicely demonstrated in several health planning contexts.[7,8,9]

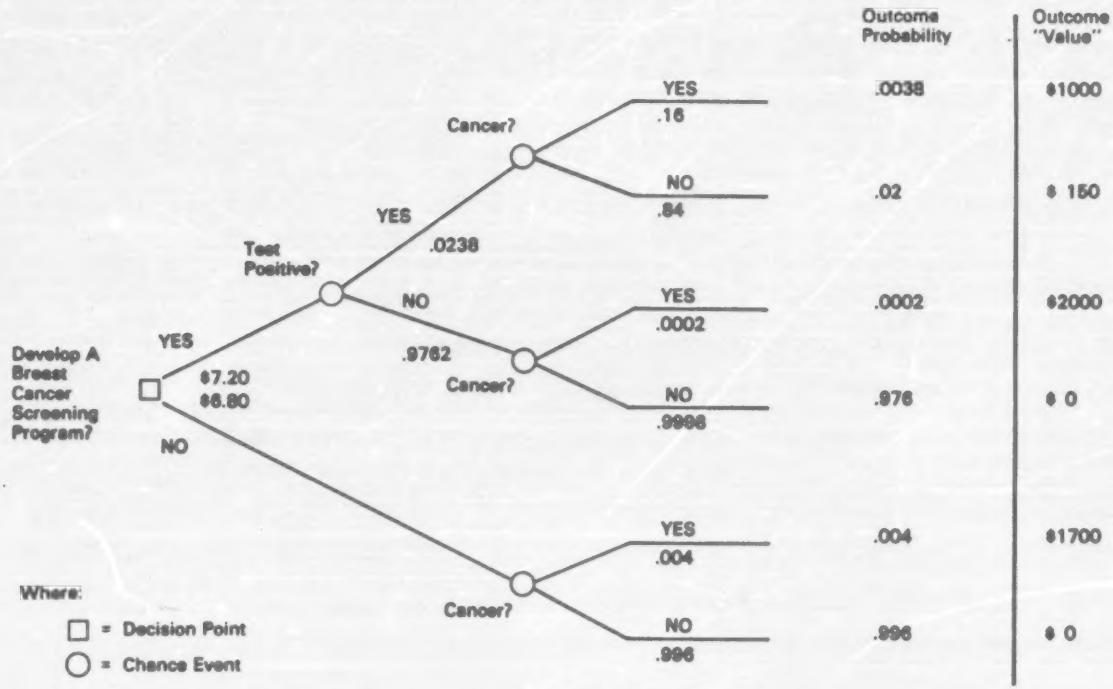
Example

A simple example can illustrate some of the points discussed above. An administrator must decide whether or not to initiate a breast cancer screening program. All women in the more vulnerable age group can be screened. Those with positive results can be called in for additional diagnostic work, or individuals can place their demands on the health care system as they perceive the need. Figure 1 is a decision-tree representation of the decision problem, in which branches emanating from the square represent decision alternatives and branches from circles are chance events. Each chance event has an associated probability of occurrence. The first alternative includes a relatively low-cost screening procedure for every woman in the serviced population. The second alternative has no initial screening costs, but could possibly incur greater medical treatment costs if later detection is associated with higher treatment costs.

This chapter does not address the issue of placing values on the outcomes in question. Let it suffice to say that the screening and treatment costs will be only a fraction of the outcomes' values, which have an important influence on the alternative chosen. For illustration purposes, values have been subjectively assigned to the outcomes. The administrator has been informed that the rate of undetected cancer in

FIGURE 1

Decision Tree Representation of Breast Cancer Screening Resource Allocation Problem



Source: Kodlin, A. (1973)

this group is four per thousand women, and the sensitivity of the screening procedure is 95 percent, whereas the specificity is 98 percent.[10]

By evaluating the tree, one finds that the expected value of the screening program is $7.20 per woman in the population versus $6.80 if one chooses not to screen. Hence, if minimizing expenditures were the dominant choice criterion, then the administrator would choose not to screen.

This representation of a decision to institute a screening program is rather simplistic, and one can observe many uncertainties in some of the probability assignments that could possibly lead to poor decisions. For instance, is the prevalence rate of four per thousand undetected cases constant across all age groups? Although other perspectives need to be incorporated in the decision-making process, I will specifically use the potential input from epidemiology and point out how an analysis of screening should include the following factors:[11]

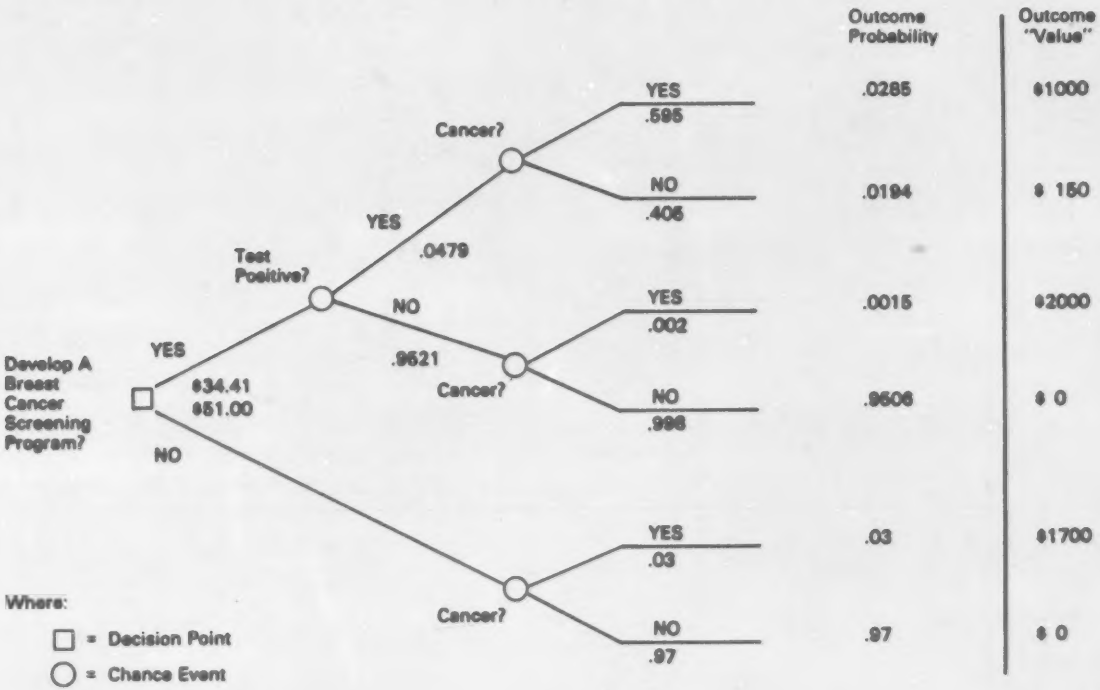
1. Age- and sex-specific incidence and prevalence rates.
2. Age- and sex-specific mortality rates from other diseases.
3. Age and sex distribution in the population.
4. Risk factors that might affect a particular patient's chance of getting the disease.
5. The efficacy of the diagnostic tests that are available for screening.
6. The effectiveness of available therapy as a function of the time of detection.
7. Complication rates associated with screening procedures.

Siu and Hancock[12] provide a good example of the use of the fourth item, risk factors that might affect a particular patient's chance of getting the disease. They used epidemiological study results to determine a high-risk population and found the prevalence rate of undetected cancer to be .03.

As illustrated in Figure 2, the evaluation of the decision tree leads to a different decision if the choice criteria remain the same. Applying the screening procedure to a population already predetermined at risk increases the probability of positive test findings, resulting in an increase of early detected cases of breast cancer (i.e., an increase proportional to the number of women screened). For the purpose of this example, the costs associated with early detection and treatment have been assumed to be lower than treatment when signs and symptoms are detected in a nonsystematic fashion. It has also been assumed that the same institution bears all costs. Hence the cost of the screening program, using this oversimplified analysis, could be as much as $16.59 ($51.00

FIGURE 2

Decision Tree Representation of Breast Cancer Screening Resource Allocation Problem Utilizing Epidemiological Data on Population at Risk



Source: See note 12.

minus $34.41) per woman in the population at risk before a decision not to institute a screening program could be justified. The administrator must then decide if resources are available to allocate to the program, or if in fact the higher costs associated with not offering the breast cancer detection program are affordable. Furthermore, the prevalence rate of undetected cancer would change after the screening program was in effect for a period of time, and incidence-rate information would then be more important. The administrator should be aware of the time-related utility of information and both the long- and short-term consequences of the resource allocation decisions made. One need only extrapolate to imagine the tree with some of the other factors included and recognize the impact that epidemiological evidence can have on the analytic process.

Discussion and Conclusions

Instruction in epidemiology and decision analysis is important for improving the health administration student's understanding of resource allocation decisions. Unfortunately, in the United States the use of both has been limited, probably because resource allocation has usually been in response to demand rather than to meet or modify the health needs of a population group, thereby limiting the need for epidemiological data. Epidemiological input has been strong in the infectious disease control area, where problems are usually population related.

Including the epidemiological perspective in health administration educational programs should help to reorient students toward placing a high priority on the health needs of the population and not only for administrative policy questions but also for facilities management and resource allocation (strategic, tactical, and technical decisions occur at all levels). This integrated approach to teaching will have sensitized the administrator to the idea and value of consulting an epidemiologist for assistance when necessary. Schoenbaum and co-workers give good illustrations of problems of health resource allocation decisions that use an epidemiological perspective.[13,14]

The ability to measure, classify, and monitor illness and disability in populations is essential to the collection of information to be used for establishing priorities in the allocation of resources for the best community impact.[15] The epidemiologist can contribute to this goal, since he or she has this knowledge by experience and training. This is not to say that most health services problems can be resolved alone or even primarily by epidemiological information. Other sources of information, such as economic, clinical, and financial, also need to be included.

Furthermore, we must not forget that an increase in the quantity of information alone will not determine the decision. Action choices are ultimately a result of political and economic values placed on outcomes, but better information increases the probability of making a decision that will in turn increase the chances of realizing those outcomes.

Decision analysis and other decision-making assistance methods, such as benefit-cost analysis and cost-effectiveness analysis, are fairly common in most education programs for health administrators. Some schools require health administration students to take an introductory course in epidemiology. In developing the vitally needed material to integrate the subjects, the following recommendations should be considered:

- Health statistics and epidemiological information can be used effectively by health administrators and policy-makers.
- The decision analytic model should be understood, and the kinds of decisions that could be affected by health statistics and epidemiological information should be differentiated.
- The problems in developing useful health statistics and epidemiological data from both ongoing records and survey sources must be defined.
- Especially important for us as educators, the pedagogical problems and their resolution in teaching the constructive use and relative value of this type of information must be recognized.[16]

Notes

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13 The University of Toronto's Course in Community Health Appraisal Methods: One Course for All Community Health Professionals

Raisa B. Deber, Ph.D.*

A postgraduate diploma in hospital administration was offered at the University of Toronto from 1947 to 1978. In September 1978, this diploma was replaced by a Professional Master's in Health Science, offered through the Graduate Department of Community Health, a division within the University of Toronto Medical School. The new master's program has four streams: health administration, community health and epidemiology, environmental and occupational health, and community nutrition. Formerly, all these fields had their own separate diplomas. A new program in health promotion was added in 1979.

Two main objectives in combining the master's streams were to train community health professionals together and to break down the barriers between the different specialty areas. One of the means chosen to accomplish this was a four-component core curriculum, wherein all the students jointly learn the common, generic material and then go on to study specialty material in their own fields of interest.

Thus, formerly separate courses in vital statistics, medical statistics, survey methods in the health sciences, and quantitative applications for health administration have been merged into a new course, "Community Health Appraisal Methods."

Community Health Appraisal Methods

The decision to merge all basic quantitative courses forced faculty members to think through a number of basic issues. Why had students in community health been studying this material? What skills were imparted? Which skills and knowledge areas were essential, which desirable, and which necessary only for specialists? What were we trying to train our students to become?

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In a series of meetings, the "inter-stream committee" found that a set of basic skills is indeed common to all programs. Students, whether administrators, public health physicians, environmentalists, or nutritionists, must learn the following:

- To determine the health status of a community.
- To evaluate the effectiveness of a program.
- To understand the basics of empirical thinking in order to use quantitative material that might come across their desks.
- To recognize where quantitative analysis could (and could not) prove useful, and when greater expertise should be sought.

For most students, it would not be necessary to become a practitioner with a firm knowledge of how to do most computations. It was crucial, however, to be a sophisticated consumer.

Thus, it was felt that biostatistics, epidemiology, and social scientific methods (especially survey techniques and research design) could appropriately be combined. Other quantitative courses of relevance to particular streams would of course be retained outside the core. For health administration, this meant that we would continue to offer operations research, financial management, health planning, and health economics in addition to the course in community health appraisal methods.

Course Design

As can been seen in Exhibit 1, the intention of the course is to interweave epidemiological concepts with the biostatistical techniques necessary to cope with them. Thus, for example, the use of basic descriptive statistics is taught in conjunction with the basic demographic indicators. A lecture on demography incorporating current Canadian data and trends is accompanied by a tutorial involving the student working out rates, central tendencies, and so on, upon a problem set of demographic data. The lecture on epidemiologic basics (person, place, and time) is integrated with table analysis—for example, the basic measures of association and statistical significance are used on a table of disease status versus age. Screening programs are connected to the 2 x 2 table and the issue of significance testing. In practice, these linkages have not always been as explicit as we would like, although movement has been in the desired direction. In addition, the weak statistical background of many of the students may force expansion of the material covered in weeks 9 through 10, at some expense to the later material taught in weeks 11 through 13.

Efforts are being made to use data in the problem sets from all of

the program streams. Thus, students can see that the same techniques are relevant to a wide range of problems, from the relationship between asbestos levels and cancer rates, to the connection between number of hospital beds and utilization. Eventually, it is hoped that at least one problem set will involve the use of the computer through the use of a "canned program" such as SPSS (Statistical Package for the Social Sciences). This has been done so far on an optional basis.

Method of Assessment

A perennial problem with any quantitative course is that the students enter with different levels of previous training and present aptitude. The risk of frustrating both good and poor students is accentuated in a course such as this, since a full-year course has been compressed into a one-semester, highly intensive course (which, however, retains full-course credit). Although it might be desirable for some students to be able to stretch the material over a longer period of time, the content is required as prerequisite for too many courses, and is central to the curriculum, in all streams. Thus stretching the course for a whole year is not practical.

Accordingly, deliberate attempts have been made to break the course into modules, particularly with regard to methods of assessment. Problem sets within tutorials are a primary method of assessment; by breaking the course down in this way, students have the opportunity to do additional work on troublesome areas. Those familiar with the concepts of a particular week will be able to complete the assignment quickly and leave; those having more trouble will spend more time with the tutorial leader.

Faculty members with training in related disciplines are used as lecturers and tutors; graduate students are not used. This heavy use of faculty resources is feasible because the class is a fairly large one (about 90 students) and has replaced four other courses (one of which had previously been team-taught by two professors). It is hoped that this merger, by eliminating the considerable duplication in the previous arrangement, will enable the faculty to spend additional time with those students who need extra help. Teaching arrangements, however, will remain under investigation. It may be possible to move eventually to a fully modularized curriculum in this subject, if that proves desirable.

This course was designed by a committee consisting of Richard Osborn (sociologist), chairman, Department of Preventive Medicine and Biostatistics; David Hewitt (statistician and epidemiologist), Department of Preventive Medicine and Biostatistics; Jack Williams (sociologist), director, Health Care Research Unit; and Raisa Deber (political scientist), Department of Health Administration.

EXHIBIT 1

Proposal for Course in Community Health Appraisal Methods

Description: The acquisition of techniques to study and measure the health of populations is the focus of the course. Topics covered will include sources and types of health data, basic biostatistical techniques including descriptive and inferential methods, analytical and descriptive epidemiology, and the application of quantitative techniques to topics such as health care delivery and utilization, and the health needs of specific high-risk populations. Substantive material and methodological topics will be taught concurrently, with an emphasis upon relations between measurement and knowledge about levels of health in the community.

Structure: The course will consist of lectures and tutorial meetings. It is proposed that two lecturers and from four to six tutorial leaders would be needed. Students would be assigned to a tutorial class for the duration of the course. Since a common set of problems will be studied, students would not be assigned to a tutorial on the basis of area specialization within the MHSc.

The class will meet twice a week, preferably on Tuesday and Friday mornings, from 9 a.m. to 12 noon, during which time there would be a lecture followed by a tutorial. The course will last approximately 13 weeks, and a proposed topic outline is as follows:

Week 1	Introduction. The health of individuals and populations. The costs of ill health.
Weeks 2-4	Mortality, morbidity, fertility, and other indices. The age-sex pyramid, dependency ratios, and the life table. Measures of central tendency and dispersion, rates, ratios, proportions, frequency distributions, and denominator data.
Weeks 5-8	Epidemiologic basics with emphasis on person, place, and time; the agent-host-environment triad; and the applications of the model in health services research. Problems of using sample data, measures of association, study design, and table analysis.
Weeks 9-10	Causes of ill health with special attention to environmental influences, screening programs, and high-risk populations. Statistical inference and tests of significance, simple correlation, and regression. The question of sample size.
Weeks 11-12	The supply and demand of medical and health care. Comparisons of tabular and correlation methods, use of controls, n-dimensional table, and multiple variables.
Week 13	The future as seen through data needs, the use of population forecasts/projections to examine changes in area needs.

(Exhibit 1—continued on next page)

(Exhibit 1—continued)

Textbooks and Evaluation: Basic texts would include the following:

Mausner, Judith S., and Bahn, Anita K. *Epidemiology: An Introductory Text.* Toronto: W. B. Saunders. 1974.

Dunn, Olive J. *Basic Statistics. A Primer for the Biomedical Sciences,* 2nd ed. Toronto: John Wiley & Sons, 1977.

Hill, Sir Austin Bradford. *A Short Textbook of Medical Statistics.* London: Hodder and Stoughton, 1977.

A Unibook paperback and an elementary statistics book such as Kilpatrick, *Statistical Principles in Health Care Information.*

Evaluation would be based wholly, or at least in large part, on in-course assessments in tutorials. Several assignments would be used to provide feedback to the students and data for marketing.

Some students will have difficulty with the course materials and may require additional tutoring beyond regular class hours.

IV. Information for Health Care: An Epidemiological Perspective

Kerr L. White, M.D.*

The purpose of information is to improve our understanding of problems and issues, as well as of the relative utility of the choices we face. The power and value of information are governed by the extent to which it is expressed simply and clearly; delivered at a level of precision commensurate with the importance of the decision on which the information has a bearing; and made available sufficiently in advance of when the decision is to be made, so as to allow its assimilation by people. Usable information generally is regarded as a desirable ingredient in optimal decision making; rarely can it be regarded as the sole ingredient, and hardly ever does it provide a sufficient basis alone for making any decision.

Most personal and political decisions are based on scant amounts of reliable information. Matters of health and health care are no exceptions; the great bulk of individual and collective decisions related to those matters use modest amounts of uncoordinated information of dubious quality. In spite of remarkable progress in the fields of information theory and communications science, the information revolution—in contrast to the data explosion—is in its earliest phase conceptually, technologically, and organizationally.

Information Systems

The purpose of an information system is to improve the acquisition, processing, communication, timeliness, and clarity of valid and reliable observations about a particular topic. The relevant observations come in a variety of forms, are made by many different kinds of observers, and flow through diverse channels. In the absence of systematic organization few sets of observations are compatible, or even comparable.

Terms and Definitions

Within the lexicon of those who work to improve information and

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information systems, a plethora of terms and related definitions has arisen. For purposes of the present discussion, the following terms and definitions have been adopted:

Data are established or asserted observations, known entities, so-called facts, measurements, or occasionally a premise or assumption. A datum tends to be unidimensional and by itself usually provides little or nothing by way of insight, understanding, knowledge, or wisdom.

Statistical (numerical) data are "facts" acquired prospectively or retrospectively in a more or less systematic fashion, but not necessarily for an explicit purpose, and not always to influence a previously specified decision. Statistics may be crude or processed and may or may not be accompanied by estimates of the error or bias surrounding their credibility.

The statistical methods employed for acquiring, aggregating, reducing, and processing data, as well as for estimating bias and error, and for other forms of analysis, employ sciencific principles and concepts. These are usually quantitative whenever possible, but the use of logic and scientific principles is of much greater importance than is the use of mathematical formulas that manipulate data.

Quantitative (statistical) information may stem from the juxtaposition or transformation of two or more facts or sets of facts (data), so that previously undisclosed or unknown "knowledge" is obtained. The transportation of data into quantitative (statistical) information may be descriptive or analytical and in either case is accompanied customarily by estimates of the credibility of the conclusions, credibility that is based on the use of scientific (statistical) methods.

The estimates of credibility and the principles on which they are based are as critical as the nature of the original observations. For example, a simple but scientifically constructed household survey of, say, attitudes toward family size, using a relatively small probability sample based on aerial photographs of a large geopolitical jurisdiction, may be thoroughly credible and useful for planning health services. By contrast, a much larger body of, say, crudely recorded physiological measures, such as blood pressure, collected by a group of enthusiastic volunteer physicians caring for a haphazardly defined set of patients, may be virtually useless for planning or evaluating health services or practices.

Qualitative information may range from prose pronouncements by authoritarian sources, through subjective assessments of such characteristics as hair color, to codified documents that have varying degrees of popular support or acceptance and differing forms of sanctions for noncompliance or infringement. Such information extends from the

putative, through the normative, to the constitutional and legislative. The information may reflect the received wisdom extant at a particular time or place or it may recite lists of legally enforceable practices or punishable offenses. Rarely is any of this type of information derived from applications of the scientific method—but that neither detracts from nor adds to its absolute veracity or practical utility.

The Purpose of Health Information

The purpose of health (or medical) information is to identify individual and collective health problems; to assess their relative severity and urgency; to estimate their prevalence and social costs; to identify and assess the relative safety, risks and efficacy of various forms of intervention; and to evaluate the relative benefits, costs, and effectiveness of measures advocated for the prevention, control, or amelioration of individual and community health problems. In short, health information, as distinguished from medical information, is concerned with the enhancement of levels of individual and collective health to which present and future populations may aspire.

In many nations, health information is rudimentary at best, particularly when compared to information about topics such as commercial transactions, road building, agricultural crops, tourism, or meteorology. In the best of situations, for example, the recording, classifying, and tabulation of causes of death when compared to autopsy records or clinical charts, are associated with error rates of 40 percent to 60 percent or more. Indeed, there is no evidence that more than 10 percent to 20 percent of all forms of clinical intervention have any scientific basis for the claims made for their efficacy or safety. To be sure, the quantitative assessment of the impact of health services on the health status of individuals and populations is in the earliest developmental stages. Balance is needed both in selecting the health or medical information to be acquired and in determining the precision of the estimates to be made. Perhaps the relatively low-precision estimating techniques of restaurant proprietors and others should serve as the models, rather than the precise bookkeeping practices of a bank or inventory control system of a diamond mine.

In summary, the codification of what little is known and useful about health and health services at all levels is inevitably a slow process. It is more probable that it will be fostered by clear thinking than by rapid computing or indiscriminate storage of data that can vary widely in accuracy, credibility, timeliness, and utility. Contributions to critical thinking are more likely to prove humane, clinically beneficial, and cost-effective than are investments in unevaluated technology, inappropriate

precision, and expensive hardware. When in doubt, it is better to be roughly accurate, timely, and useful than unduly precise, late, and irrelevant.

The Purpose of a Health Information System

The purpose of a health information system is formal organization of the concepts, methods, manpower, equipment, and other resources for acquiring and processing data needed for delineating health problems and hazards, for assessing the relative efficacy, safety, and cost-effectiveness of differing forms of intervention, and for evaluating the impact of services provided on the health status of the populations served. Given the current state of medicine as both science and art, as well as the vagaries of biological processes, personal behavior, and administrative and political processes, available data require highly selective marshalling and processing before they can be transformed into useful information. It is the function of a health information system to guide the processes of identification, labeling (nomenclature), coding, measurement, reduction, analysis, and presentation, so that the resulting estimates are scaled, timed, and presented in relationship to the magnitude and urgency of the decisions to be made. It follows as a general principle that the only data acquired systematically should be those that are known to apply to the process of making important decisions. The importance of a decision is determined by the volume of suffering with which a given problem is associated, the proportion of the population affected, the costs of doing nothing, or the extent of various forms of political pressure.

There is a final purpose to which any collection of data should be dedicated: the production of intelligence, in the original military usage, about health and health affairs. Even the most scientifically garnered data, creatively compressed and imaginatively displayed, are unlikely to influence personal behavior or political decisions unless they are interpreted and presented in the light of the contemporary beliefs, habits, and values. This fundamental truth is as valid on the local level as it is within the World Health Organization.

Characteristics of a Health Information System

With the previously described generic principles and definitions in mind, it is now possible to concentrate more directly on the characteristics of a national, state, or municipal health information system (HIS). In order to serve an entire nation's population, it is usually necessary to recognize and integrate the needs of at least three geopolitical jurisdictions, i.e., those at the periphery, such as villages, precincts, neigh-

borhoods, counties, or communes; those at intermediate levels such as provinces, states, districts, regions, or republics; and those at the central, national, or federal government level. The overall purpose of the HIS is to inform the public, its political representatives, policy-makers, administrators, and providers about the nature and extent of the people's health problems, and about the impact of a wide variety of influences and services on those problems.

The underlying concepts should be based on behavioral and learning theory, more recently refined further as *information theory*. The fundamental thrust of an HIS (and its components) should be directed at improving the information and motivation underlying decisions that will enhance health and productivity. The immediate practical concepts and activities should focus on political realities, public education, and useful and usable scientific and technological knowledge. The essential contribution of an HIS is to assist in making the most of resource allocation, both among competing economic and social sectors, and within the health sector—in accordance with agreed-upon priorities—and to educate the public about these matters. The understanding should be clear that it is impossible to indulge simultaneously in profligate expenditures on unevaluated "half-way" technology—directed at some illusory, but ill-defined goal of quality—to achieve equity, if not equality, of access for the entire population while containing health care costs within tolerable bounds. Individual compassion for the individual patient must be tempered by statistical compassion for all the people, if social justice and fiscal prudence are to play any role in the management of health affairs.

Although an HIS may be administered centrally, it is essentially a set of standards and procedures for the *one-time*, practical acquisition of *essential*, *minimum*, *uniform*, and *basic* data sets bearing on health care needs and services. All elements are part of an iterative or cybernetic process in which the benefits associated with the current efforts of the contemporary health care enterprise determine the health status of the population prior to the application of the next set of services. In determining the structure and processes, those responsible for developing an HIS should remember that its only justification is to serve specific needs and purposes in accordance with previously agreed-upon levels of geopolitical aggregation, classification schemes, time periods, and output formats.

Goals and Objectives

Overall Goals

An HIS should strive for simple presentation, including graphic displays of appropriately selected data. The technological capacity to

accomplish this is currently available, but that is not the principal problem facing the developers of an HIS. The fundamental task is to create imaginative depictions of critical relationships among the five classes of basic data components in the system: *health status, resources, use, costs,* and *outcomes* (or *benefits*). On the one hand it is essential to minimize respondent burden, whether through survey instruments or clinical and administrative records and on the other, it is essential to communicate relevant and timely intelligence to those who need it. When in doubt, an HIS should be seen as an instrument for guiding future policies and practices rather than as a mechanism for recording historical transactions and unhappy events. In general, it should be the policy of an HIS to prohibit the regular acquisition of any data that are not justified by documentation—based on extensive practical administrative use, or on scientific field trials—so that eventually the data can be expressed in forms that will have a potential, if not early, influence on a substantial decision. It is the objective of "political arithmetic," and specifically of an HIS, to assist in quantifying a population's burden of illness and disability in order to determine certain priorities. Facts should be substituted for subjective opinions and informed intelligence for political pressures.

Specific Objectives

Let us presume, for example, that is is the proclaimed goal of a society or its ministry or secretariat of health to assure equitable access for all to health care services of acceptable quality at an affordable cost. The HIS might need to create measures, develop indicators, and make estimates that reflect changes in more specific and objective areas, such as the following:

1. Geographic, social, and financial *equity*, i.e., elimination or reduction of transportation or financial barriers to needed services arising from: unavailability of adequate or appropriate resources; racial, cultural, educational, age, or sex bias; or inability to pay.

2. Assurances that the *quality* and type of care are scientifically and technologically appropriate and acceptable to both the providers and recipients of care.

3. *Efficiency* and *cost-effectiveness* in the provision of health services required for prevention, diagnosis, treatment, and enhancement of health.

4. Payment for or provision of *services for* economically or medically *catastrophic conditions.*

5. *Improvement in health status*, accompanied by elimination of maldistribution of resources and inequitable access.

Impediments to the Achievement of Objectives

Efforts to achieve such goals should be accompanied by public accountability with respect to the progress made. Once again, this requires the conversion of raw data into information, which then is used to develop intelligence about the conduct and soundness of the policies and the achievement of progress toward stated goals and objectives. Examples of the data problems that handicap these functions in actual practice include:

1. Failure to understand the need for adequate and relevant information.
2. Insufficient lead time for planning and development of information systems.
3. Unclear designation of specific authority and responsibility for development and maintenance of those systems.
4. Inadequate collaboration among policy-makers, planners, administrators, statisticians, epidemiologists, economists, sociologists, and computer specialists in the design and operation of the systems.
5. Insufficient resource allocation to support the systems.
6. Inadequate internal allocation of resources for analysis and creative presentation of information to the users.
7. Failure to develop constituencies whose active and constructive use of the information justifies the systems and generates a continuing demand for the commitment of adequate resources for their support.

Components and Coordination

Health Information Center

A national, state, or local health information center, with a mandate to establish and monitor standards and procedures for the acquisition of all data and the basic formats of all outputs at the designated level, is a prerequisite for the application of an agreed-upon conceptual framework and attainment of credible performance and cost-effectiveness. Both competent statistical staff and close ties with politicians, policymakers, planners, administrators, and practicing health personnel are essential for success. Although these complex relationships may be more limited at the intermediate and peripheral (e.g., state, county, municipal) levels, they are perhaps of greatest importance because not only are most data found at these levels, but a great many priorities and resource allocations are established at these points. Although there may be a need for fewer staff at each of these levels, they should be trained no less appropriately than those in the more central offices.

The national, state, or local health information center should be headed by a permanent director who is a senior professional official or civil servant. Although reporting directly to the minister or secretary of health for the jurisdiction involved, the director should be sufficiently secure and independent to preserve traditions and practices that make the information generated by this center credible and useful to groups of differing social and/or political persuasions. To deliberately politicize a health information unit is to run the risk of undermining its reputation for objectivity. The unit's long-term capacity to contribute the nonmonetary component of the arithmetical equation used in political decision-making processes should be protected carefully. Indeed, the director of a health information center should be regarded as the statistical ombudsman of the people's health and their health services.

In principle, the health information center should comprise three or possibly four *major administrative elements:*

1. A *technological and scientific assessment unit,* which has responsibility for obtaining evidence or conducting studies that bear on the relative efficacy, safety, costs and benefits of currently used or newly advocated forms of intervention is an increasingly important element, especially at the national or central level. This unit should endeavor to make available to health personnel, politicians, planners, and the public answers to questions such as the following (modified from D. A. K. Black):

- What are the aims of the procedure or service in question?
- How many people, and of what kinds, are potentially eligible for help from these procedures or services?
- What proportion of these people actually get help?
- What kinds of people are they?
- Who fails to get help?
- What determines who gets this help and who does not?
- Does this procedure or service do any good or make a discernible difference? If so, how much difference does it make and to whom?
- What does this procedure or service cost?
- How do these costs compare with those of potential substitutes?
- Who pays?
- What does the public—those served, those eligible but not served, and those ineligible—think about the procedure or service?
- What impact might the procedure or service make on the demand for or effectiveness of other procedures or services?

Although a computerized information system such as MEDLARS may be suitable for certain applications, the capacity for storing,

retrieving, and transmitting all possible information bearing on questions such as those listed above is of trivial importance compared to the task of obtaining credible answers themselves. Where resources are in short supply they should be used for obtaining answers to important questions rather than for processing information of dubious or ephemeral value.

There are other types of information relating to poison control, adverse drug reactions, and management of complex biochemical and physiological derangements that can be stored, updated, retrieved, and transmitted by computers to on-line CRT screens, at considerable costs. However, except where large-scale interactive networks are currently available—and most of these are still in the experimental and developmental phases—it would appear prudent to await the advent of low-cost microprocessors and satellite networks before advocating their adoption, especially in the least affluent jurisdictions. Indeed, since these systems usually serve the needs of those few people with rare or unusual problems, they hardly can justify a high social or resource priority, even in an extremely affluent or profligate community, except for purposes of experimentation and development.

The technological and scientific assessment unit requires the expertise of statisticians, epidemiologists, economists, and computer scientists, and, as such, could be an integral part of the health statistics information unit described in item 3. Its staff also will need to interact closely with clinicians and biomedical and behavioral scientists. In some settings this unit might be separated administratively from the other major health information system elements but, as in the case of a health services research unit, the location of all three under one responsible official has much to commend it, provided that individual is suited to the task by virtue of training, experience, and perspective. In all probability, an epidemiological, as well as a clinical and statistical orientation, would be essential.

Two additional comments are in order. First, a technological and scientific assessment unit is quite different from a health sciences library. The former seeks to identify practical, efficacious solutions to contemporary health problems and clinical measures that are cost-effective and safe. Libraries are repositories for information that may or may not survive the test of time and that may or may not have some ultimate practical or even theoretical value. Second, the sifting of available evidence purporting to document the alleged benefits of various forms of intervention is done best by application of scientific methods, but it is also possible to use modified Delphi or consensus methods, which involve the experience of experts. This method may be employed in the earliest

stages of technological and scientific assessment. Indeed, many useless procedures such as cupping, leaching, gastric freezing, portacaval shunts, and certain forms of bed rest have been disposed of, either through the passage of time or by groups of experts meeting in solemn conclave. Although those may be useful expedients, they are poor substitutes for science, and when employed they should be called by their appropriate names.

2. *A health services research unit*, which has responsibility for developing and testing new arrangements for organizing, staffing, managing, financing, and evaluating the provision of health services, is a second important element in a health information center. A close interaction of the staff is needed with those responsible for social and support services, as well as for the personal health services. All of these activities involve the disciplines associated with the technological and scientific assessment unit and the health statistics information unit, with the probable addition of representatives from sociology, psychology and operations research.

3. *A health statistics information unit* is the central focus of this discussion and the indispensable element in any HIS.

In most settings, on the one hand, it would seem desirable, if not essential, for the health statistics information unit to be designated the lead agency, particularly where major political and administrative emphasis has been placed on the creation of a dynamic health information system for managing, monitoring (surveillance), and evaluating a community's or nation's health care status and its health care enterprise. In such instances, and particularly where an epidemiological, population-based viewpoint prevails, the other two units would fall naturally within this orbit.

On the other hand, where a health statistics information unit has limited its experience to the recording and tabulation of vital events, supplemented by the conduct of the occasional ad hoc survey, and has shown little or no interest in developing statistical information bearing on health problems and health services, the need for a different orientation, and even for new leadership, may necessitate most of the functions subsumed by the three units described here being assigned to some new entity An exception might be made in the case of responsibility for the registration of vital records. This issue is, for many jurisdictions, a serious consideration. It is less a matter of the importance of this activity than it is a matter of the way in which health information is perceived and used by managers, planners, and politicians.

4. *An archival and legislative unit* could be incorporated with an HIS. This would provide a reference service covering current health

legislation, regulations, policies, practices and general problems, the so-called fugitive, or subterranean, literature. Ad hoc studies conducted by the HIS or by research institutes and universities could be referenced or retained here. It is essentially a reference library, serves a bibliographic function, and is not necessarily quantitative.

Principles for Development of an HIS

Here is a summary of selected principles for developing an HIS:

1. Start with a small, appropriately trained staff committed to an agreed-upon conceptual framework and to a set of organizing principles for constructing the HIS.
2. Focus on common health problems that currently affect large numbers of people frequently, cause great suffering, and impair personal and socioeconomic well-being.
3. Express findings in visual (graphic) formats that emphasize timeliness and utility over precision and technical virtuosity.
4. Employ limited sets of basic uniform terms, definitions, classifications, codes, standards, and conventions from the outset, and expand them gradually in a balanced fashion, as needs are demonstrated and resources permit. Do not, for example, emphasize great detail in the coding of deaths from rare diseases at the expense of estimating the number of persons with fever, malnutrition, diarrhea, headache, arthritis, heart failure, or occupational and traffic accidents, which could be treated or prevented expeditiously and inexpensively if resources were used sensibly.
5. Strive to see that all forms of intervention and all personal and environmental services are supported by scientific documentation of their effectiveness and efficiency.
6. Remember that the words "statistics" and "state" have the same origin; the sole value of statistics is to enable the state and its citizens to improve their individual and collective well-being. Health statistics and health information are essential elements of political arithmetic.

Principles for Data Acquisition

The *only* reason that any society creates or permits the existence of a formal, or even informal, health care establishment is to assist its citizens in improving their health and in alleviating their perceived health problems. From this fundamental premise it is possible to derive eight principles that could guide the creation of a health statistics information system and the data it collects:

1. The data should be *person-specific*. The system must have the capacity to describe health problems, attributes, events, activities,

services, and outcomes, for example, in terms of numbers of individuals possessing them. Although it may, in some settings, be desirable and even possible to count all persons in a population, sampling methods are frequently adequate and more accurate for making useful estimates, and they are usually much less expensive.

If the system is not based on person-specific data, different sets of data are subject t. the so-called ecological fallacy, which is to say, each data set may relate to a different subset of the population. For example, it is usually more important for a manager to know how many people are severely disabled than it is to know how many disabling diseases, classified by the International Classification of Diseases, exist in the population. Similarly, it may be more important to know how many children are immunized appropriately than it is to know how many immunzations were given by the nurses.

2. The data should be *population-based*. The system must have the capacity to make comparisons within and across geopolitical jurisdictions and over time. This can be accomplished best by the statistical process of standardization, not only for differences in the age and sex structures of populations, but also for such factors as disability, severity, chronicity, urgency, and case mix. For the equitable distribution of resources, on the basis of need, among peripheral and intermediate geopolitical jurisdictions, politicians and planners need such comparisons. They are made best by the calculation of rates in which both numerator and denominator use persons as units; the numerator would be determined using sample surveys of households or clinical records, and the denominator using censuses or population estimates. Nevertheless, the politician is most impressed by, and the manager finds most useful, information expressed as numbers of persons, rather than as rates. The transformation to a population-based number (accompanied by the estimated error) is made readily from a rate.

Comparisons over time within and among geopolitical jurisdictions is needed, in order to determine whether progress is being made toward specified goals and objectives. The frequency with which temporal comparisons are made should be related to the expected rate of change in the phenomenon being observed. For example, acute conditions may change more rapidly than chronic conditions, and treatable or preventable conditions should decrease more rapidly than those for which no treatment is known or available.

Most current statistics bearing on health services tend to be practice-, clinic-, or hospital-based and, in the absence of geocoding (i.e., identifying the person's place of residence), it is impossible to generate population-based statistics. This is a serious deficiency and a major

impediment to the use of much health information for setting priorities and allocating resources, especially in peripheral and intermediate jurisdictions.

3. The data should be *problem-oriented*. The system must start with the identification, labeling, classification, and counting of the people's perceived health (or medical) problems. The fundamental task of the health care establishment is to assist in the prevention, resolution, or management of these problems. There is little virtue in making a medical diagnosis, and even less in recording and counting diagnoses, unless the individual patient or the population sooner or later is helped perceptibly.

In most settings throughout the world, approximately 20 common problems account for about one-half of the demand made on health services, and about one-half of these 20 problems are painful. After the list has been extended to the 50 most common problems, the frequency of presentation of a given problem tends to decline rapidly to less than 1 percent of visits. Thorough appreciation of these relationships is all the more important in light of the renewed emphasis on self-care and primary health care. Personnel and facilities can be sized, deployed, and organized in relationship to the distribution of the problems that beset the living, rather than to the distribution of the diagnostic labels for the disease that afflicted the dead.

Health problems are perceived initially by individuals, their relatives or friends, and are described in lay terms, not in medical terms, which are code words used by health professionals for their own purposes. In constructing nomenclatures and classification schemes for problems described by lay persons, as well as for problems seen at the level of primary health care, it is important to recognize colloquial terms and to develop dictionaries that incorporate semantic and linguistic equivalents.

4. The data should be *provider-specific*. The system must have the capacity to identify where and by whom a service was provided. The deployment of resources effectively and efficiently implies a requirement that they be related to the distribution of the people's problems over space and time. To monitor these relationships, as well as the quality, benefits, or outcomes of care, the individual and his problem need to be linked to the provider, and all three to the population served. In addition, it is important for the manager to ascertain that simple, treatable problems are managed at the lowest appropriate levels, at the earliest possible time, and with the least expensive use of resources—and not vice versa, as happens frequently in many affluent jurisdictions.

5. The data should be *procedure-* or *process-specific*. The system must

have the capacity to identify the forms of intervention used, in order to enable monitoring of the distribution, quality, and appropriateness of care, and the uses of resources and costs incurred. In general, it is desirable to start with short lists of broad categories of commonly employed procedures, processes, or products, rather than with long classifications of all possible forms of service.

6. The data should be *period-specific*, that is, the system must have the capacity to relate persons and places over periods of time. Again, the precise structure of the recording instruments and methods employed should be related to the decisions to be made and the geopolitical levels involved. For monitoring industrial, agricultural, and traffic accidents requiring emergency service it may be desirable to record time of day, for example, whereas the monitoring of seasonal epidemics may require identification only of the day or week.

7. The data should be *practical*. The system should seek to minimize respondent burden, recording time, and observer variation. Furthermore, the one-time acquisition of data should serve multiple purposes.

8. The data should be *parsimoniously selected*. The system should not countenance the routine (or even ad hoc) acquisition of *any data* for which there is not clearly written documentation that it will be transformed into information that has the high probability, if not the certainty, of influencing a decision of substantial magnitude. A sound rule is: When in doubt leave it out!

These eight primary principles should guide a purposefully constructed HIS. As an aid to their recall they all begin with the letter P.

Operational Considerations

Organizational and Functional Principles

The precise organizational configuration of the HIS will depend upon cultural, economic, organizational, and administrative traditions and functions at each geopolitical level. In general, however, the HIS should be developed from the bottom up, rather than from the top down. Although the leadership, and even the overall design of the system, may originate at the national level, it never should be forgotten that the sole objective of the HIS is to serve the needs of all the people, those who seek services and receive them, as well as those who need but neither seek nor receive appropriate services. At the levels of self-care and primary health care there is rarely, if ever, an inappropriate demand or cry for help. Indeed, even a person who seeks medical care and has no clear physical affliction must have some problem, possibly social and psychological.

It also may be stated, as a general principle, that there should be some statistical staff—even it is is only one person part-time—at each

peripheral and intermediate level, as well as at the central or national level. For example, in a population-based, managerially oriented, decentralized health care enterprise, one-half of the staff might work at the peripheral level, and the others might be divided between the intermediate level and the central office. At the central office, there might be at least an epidemiologically oriented statistician, a statistical analyst with training in graphic presentations, and a technician capable of using a large hand calculator or a minicomputer.

As the HIS evolves and its utility is demonstrated, its resources are likely to increase. A fully established HIS for a large, affluent jurisdiction might encompass the following major functions:

1. *Presentation of Information and Analysis.* Although the acquisition of data for an HIS begins with the people and their problems, the output of the system must meet the perceived needs of decision-makers at all levels, including the politicians, policy-makers, administrators, and, of course, the people themselves.

The customary pattern is to spend 10 percent of the budget and effort on planning data acquisition, 70 percent on collecting and tabulating it, 15 percent on analysis, and 5 percent on presentation. A more realistic approach would allocate 30 percent to planning the system, 20 percent to acquisition and tabulation of data, 30 percent to analysis, and 20 percent to presentation. If such a scheme were adopted, more than two-thirds of the HIS's resources would be devoted to the planning, analysis, and presentation phases. This involves close liaison with all potential users of the information, especially those responsible for setting priorities and allocating resources and those responsible for managing and evaluating services.

Both present and future needs for information, and the utility of current methods of analyzing and presenting information, should be the subject of frequent frank discussions among all concerned. The unit responsible for these functions should be constantly alert to emerging health problems and issues that are of social, economic, and political concern, as well as to emerging knowledge and technology that could prove efficacious and cost-effective. The design of the system is an iterative process in which the problems to be addressed and the progress to be made are always kept to the forefront.

At least two or three types of publications seem desirable. They should be characterized by brevity, clarity,and graphic presentations wherever possible. Few nonstatistically trained persons can read a table.

At one extreme, a periodic, perhaps annual, report on the state of the nation's health should be issued. It might start by depicting such types of information as the ten leading health problems—by national, intermedi-

ate, and peripheral jurisdictions; the ten most readily preventable health problems; the ratios of different types of personnel to each other and to different facilities and other resources; the ten most expensive procedures or treatments; the ten population groups at greatest risk of succumbing to illness or injury; the ten hospitals with the highest age, sex, diagnosis, and severity standardized case-fatality rates; or the ten hospitals, similarly standardized, with the highest bed turnover rates. In addition, each issue might include two or three more detailed chapters examining special problems, such as those of children, the aged, the mentally ill, or those with trachoma, or those sustaining agricultural accidents. These chapters would change from year to year, as public concerns and political or health priorities shifted.

At the other extreme, short, one-page graphic displays with a brief explanatory text should be issued at more frequent intervals, weekly or monthly. Here, the use of suitable health indicators or profiles facilitates the clear and parsimonious display of a considerable amount of raw data. Usually a single topic could be presented, such as level of children's immunizations, progress of an epidemic, or across-area comparisons of rates for procedures of dubious benefit (e.g., tonsillectomies) or of established benefit (e.g., fluoridation of water supplies).

Between these two extremes, and if resources permit, intermediate-sized publications of interest to restricted or specialized audiences could be published. When the data permit, more extensive breakdowns might be provided.

In general, the first two types of publications will tend to suggest what and where the problems are, while the latter type should help to shed light on the causes of the problems, or at least suggest likely hypotheses for further ad hoc studies.

2. *Standards, Conventions, and Procedures for Acquisition and Processing.* Many jurisdictions have little in the way of an HIS, and others have vast arrays of uncoordinated "data systems" with heterogeneous outputs that preclude comparisons over time and place. The latter is a consequence of each "data system" employing different definitions and classification schemes, for example, or using different recall periods or age intervals. It is important, therefore, to have some one person or unit responsible for the promulgation, monitoring, and revision of standards, definitions, and procedures to be used at all levels. At least a core of these standards, definitions, and procedures should be agreed upon by all levels, even if these are expanded in certain jurisdictions or for special purposes. Among the matters to be considered are problems of supervising the overall quality of the HIS, including those of reliability and validity; data acquisition; minimization of

reporting burden; confidentiality and privacy; sample design and size; selection of nomenclature; classification and coding schemes; tabulation and analysis formats; and matters relating to the size and utility of each measurement in relation to its associated error, cost, and potential contribution to the problem it addresses. Output conventions relating to such matters as age, sex, socioeconomic level, occupation, education, and geography—as well as the major relationships to be displayed among the five classes of statistical data employed by the HIS—also should be under the purview of this unit.

3. *Terms, Definitions, and Classifications.* Reasonably comparable, if not uniform, health statistics require the use of established terms, classifications, and coding schemes throughout the HIS. Many of these will be international in origin and scope. Although others will be nationally specific, efforts would continue toward the evolution of semantically and linguistically equivalent international practices. Experience has established the value of *uniform minimum basic data sets.* Originally developed for use in the registration of vital events and used on birth and death certificates and related documents, the same principles have been applied in some settings to data sets for ambulatory care, hospital care, long-term care, manpower, and facilities. Similarly, classification and coding schemes could be developed not only for cause of death, but also for lay terms; for terms used in primary health care—including reasons for seeking care; and for hospital care. Also, terms for such attributes as functional capacity or disability, severity, complexity, chronicity, and urgency would be useful in a classification system.

4. *Determination and Promulgation of Statistical (Data) Components.* Each of the five fundamental components of an HIS requires at least special attention and, when possible, additional staff to deal with the specific problems of data acquisition and integration within the overall system. Although specific items will vary over time and place, some examples of the classes of data that could be considered are:

Health Status. Symptoms of discomfort, disability, disease, and need for services; clinical health examinations, including psychological, physiological, and biochemical measurements; data on restricted activity, bed disability, coping status, and income loss; data on incidence and prevalence of professionally determined morbidity (diseases, disabilities, accidents, impairments, and death).

Health-Care Resources. Simple counts of personnel, beds, health centers, hospitals, major equipment, and other tangible elements are the easiest to obtain but perhaps the least useful. Increasing emphasis is being placed on the type and quality of services provided, sometimes

including measures of the volume of such services, in order that the competence, effectiveness, and geographic location of the services may be assessed in relationship to measures of health status, particularly of need. Examples might include: rehydration treatments, vasectomies; immunizations; antibiotic injections; tranquilizer prescriptions; brain and body CAT scans; open-heart surgical procedures; inhalation therapies; home care visits; physiotherapy instructions; and therapeutic listening. The health care resource component can be one of the simplest or one of the most complex to measure. The real issue in the management of health resources, however, is not how many doctors, nurses, and auxiliaries there are, or how busy they are, or how many hospitals exist and how high their occupancy rates are, but what services of established efficacy are provided as effectively and efficiently as possible to the people who can benefit most from them. Activity should not be confused with accomplishment.

Use. Estimates both for *persons* using, and for *volumes* of services used, should be developed for primary health care, general hospital care, mental health care, sub-specialty care, long-term, and home care—as well as for use of laboratory, X-ray, and other technologically based services. Volume of services and number of persons cared for must be contrasted, because the object of the exercise is to resolve the individual's health problem as expeditiously and economically as possible, rather than to order tests or make and code diagnoses.

Costs. Capital investments, including initial and replacement costs and operating costs as well as their associated indirect costs, should be estimated in relationship to both the general populations served and the subsets of those populations who seek or receive services. Where feasible, charges or costs associated with the services should be calculated for the units of service, for the volumes of services and facilities used, and for frequency distributions of services provided per person using them. Again, the emphasis should be on the effective and efficient solution of the patient's problem, not on the activities of the health care enterprise.

Outcomes. Although perhaps the most complex to measure, these are probably the most important. The impact of health care *resources* deployed and of services used at time *A* should have some discernible impact on the *health status* of the population served at time *B*. The information loop is closed with feedback from measures of the *outcome of services* provided. Many of these measures are similar to those used for measuring health status. Other indicators might include: rates for persons with days in pain; consumption of nonprescribed (or prescribed) analgesics, sedatives, or tranquilizers; days homebound; restricted activity days; hospital-bed days; and aberrations in growth, weight, or

functional capacity. Much methodological work is needed in this area.

5. *Data Processing.* This is the unit to which many HISs give most attention and on which they spend a major part of their resources. Without diminishing the benefits of the computer or even of electronic data processing, these machines only receive, store, manipulate, and retrieve data; they are no substitute for clear and logical thought. They are a means toward an end only. Whether tabulation, storage, and analysis are done centrally or peripherally will depend upon each jurisdiction's size, administrative structure, and resources. Again, it is better to process a little useful information than hundreds of pages of computer printouts that are never used.

6. *Research and Development.* Few jurisdictions will be able to afford the luxury of a staff dedicated to the development of new methods for acquiring and presenting information about health and health services. More narrowly, the work of such a unit might initiate its efforts by creating innovative ways of expressing relationships within and among the five major data components of an HIS. These include multidimensional graphic displays of ratios, rates, and proportions for variables of critical interest to managers and politicians. The development of health indicators, indexes, and profiles is still at a rudimentary stage. Methods of standardizing for severity, pain, disability, chronicity, impairment, urgency, complexity, and case mix are all in need of active work. Further development is needed for: geocoding; computer mapping; and computer transformations from street addresses, census tract blocks, or villages located on a map grid to varying geopolitical configurations. The preparation of do-it-yourself kits for conducting sample household interviews or medical record surveys would be of immense value both for less affluent jurisdictions and for small area studies in densely populated regions. Once solved, the "denominator problems"[1] would enable rates to be calculated for jurisdictions in which a population or panel register, or even a census, does not exist. Similarly, techniques for transforming measures of volume of services into counts and rates for persons served is a worthwhile methodological problem on which little work has been done.

To date, the resources expended on these types of problems have been slight in contrast to those spent on, say, computer simulation or on the modeling of health services systems, particularly when these studies employ data of questionable utility. Conceptual and creative talents in health statistics—in contrast to technical virtuosity—are in extremely short supply. The application of the former talents to fundamental problems, such as those described, is preferable to attempts at solving more esoteric problems. At best, the latter should be left to universities,

although their capacities are, of necessity, limited until the appropriate data are available.

Mechanisms

Since statistics, especially health statistics, are the business of the state and hence the people, it is essential to involve persons external to the HIS, or even governments at all levels, in order to develop broad bases of advice and understanding.

Every nation should have an active national health information system committee (NHISC—in the United States, currently referred to as the National Committee on Vital and Health Statistics), with a rotating membership drawn from users and producers of health information and statistics at all geopolitical levels. Not only health statisticians from operating agencies and universities should be included, but also epidemiologists, demographers, economists, sociologists, administrators, planners, and clinicians (physicians and nurses especially). The committee should recommend policies and guidelines for overall development of the HIS. In many settings, the committee will be advisory to the minister or secretary of health, and in some settings there will be an analogous internal standing committee to deal with practical problems of implementation. The NHISC should publish a periodic, possibly annual, report commenting on the HIS and proposing changes, additions, and especially deletions of outmoded reports or useless data acquisition requirements.

Analogous committees should be established at state and other intermediate and peripheral levels. Periodically all committees should be brought together for general discussions

Practical activities of the NHISC and analogous committees can include the use of working parties and technical consultant panels to deal with a wide variety of special problems. Here, membership usually should be extended to include informed lay, or public, representatives. These panels, for example, can determine, and have published, the uniform minimum basic data sets to be used universally for such matters as lay reporting, primary health care, acute hospital care, long-term care, manpower, and facilities. In addition, the panels could develop the following for adoption by legislative bodies at intermediate and peripheral levels: uniform standards for household interviews; epidemiological or examination surveys; uniform standards for protection of the confidentiality of records and individual privacy; and model health information and statistical legislation.

Other panels might deal with the special problems of information needed for the development or improvement of: primary care; the care

of mothers, children, or families; or the care of the aged or mentally handicapped. Still others might deal with the need for improved statistics on such matters as environmental hazards, occupational stress, food additives, population dynamics, cigarette smoking, or toxic substance abuse.

In summary, these external groups should not supplant internal bureaucratic arrangements for fostering collaboration and coordination through the mechanisms discussed above, but rather should be used to ensure the widest possible involvement of users, producers, and the public in generating purposeful information that relates to individual and collective health and health services. Again, it cannot be overemphasized that the HIS should be based on learning theory, on information theory, on the notions of feedback and cybernetic loops—not on antiquated conceptions of recordkeeping or data collection. The progenitors of recordkeeping concepts gave birth to the origins of "political arithmetic"; data collection represents the preoccupations of self-perpetuating bureaucracies.

Resources

Personnel. This resource is always in short supply. For example, the number of trained health statisticians (in contrast to biostatisticians, vital registrars, demographers, medical record administrators, epidemiologists, and operations researchers) throughout the world is extremely small. The giants of this field—Petty, Graunt, Farr, Nightingale, Ryle, Pirc, Dunn, Reed, and Sand—have not been replicated. While it is true that they started by counting the dead, their major concern was with improving the lot of the living, and even of the unborn.

Orientation. A large measure of the responsibility for the current state of affairs must be attributed to the separation of "public health" from "private medicine." This division has been institutionalized, on the one hand, in schools of medicine, which have become increasingly preoccupied with molecular events, and, on the other hand, in schools of public health, which have pursued so-called categorical programs for specific diseases, to the exclusion of general services for common problems. Both approaches are removed from the realities of the ways in which individuals perceive and respond to health problems, and from the ways in which health practitioners—traditional and contemporary—try to respond to those problems, especially at the level of primary health care. This issue is central in the design of an HIS. If a health program is conceived of as an aggregation of quasi-independent categorical or specialized activities—some operated in the public sector and others functioning within the private sector with more or less super-

vision by governments or other publicly accountable bodies—the HIS would try to coordinate the pieces at some central point. This task could be regarded by some as hopeless. If, however, the HIS is seen as the "quantitative (and where necessary, qualitative) ombudsman" of *all* the people, then it is built gradually from the bottom up, using the principles and methods described in this article.

The renaissance of primary health care seems to favor the latter philosophy. If primary health care is to be regarded as the underpinning and infrastructure of the entire health care enterprise, it becomes imperative that at each geopolitical jurisdiction the components of the HIS be restructured from the bottom up. To accomplish this there is a need to reorient the training of health statisticians in universities, to develop intermediate-length (3–6 months) and short-term (2–4 weeks) retraining courses, and to provide manuals (looseleaf with replaceable modules) and programmed self-instructional texts.

Since the number, type, and level of training and experience of statistical personnel varies widely across jurisdictions, it may be most useful to suggest certain guidelines for establishing priorities for the tasks to be carried out and, by implication, the skills required:

- It is better to estimate the extent of the most disabling and the most readily treatable problems among the living than to record the causes of death.
- It is better to focus on the earliest stages of preventable health problems than on the final stages of diseases.
- It is better to provide a simple chart or graph early than an elaborate table late.
- It is better to provide what the politician and administrator can understand and use than to provide what fellow health statisticians can admire.
- Mathematical wizardry and computing virtuosity are not substitutes for clear thinking.
- Again, it is better to be roughly correct, timely, and relevant than unduly precise, late, and irrelevant.
- Finally, supply every health care administrator and statistician with a copy of Finagle's "Laws of Information":

The information you *have* is not the information you *want.*
The information you *want* is not the information you *need*!
The information you *need* is not going to be available until the health administrator and statistician start collaborating closely!

Equipment. This resource has been referred to earlier. There is no shortage of computing technology and equipment available, and much more is in sight. Where a three-level system is envisaged and money is no

problem, a series of peripheral minicomputers, linked by an interactive network to larger units with more storage at intermediate and central levels, is probably useful. In general, it is best to specify the characteristics of the output desired, the limitations of the input available, then have computer firms design competitive systems and enter competitive bids.

Budget. There is never enough money. If all four administrative elements described earlier (technological and scientific assessment unit, health services research unit, health statistics unit, and archives and legislative unit) are encompassed by the HIS, then a rough rule of thumb would be to spend about 1 percent of the total annual health expenditures (public or private) on "information." Industries vary widely but, in general, they spend about 1 percent to 5 percent in this area, including so-called research and development. In any event, whatever funds are available probably are spent better on personnel with analytical capacities than on more electronic gadgetry.

Utilization

The demand for information, whether as formal reports or as special studies, will suggest its utility. The magnitude, frequency, and direction of change in statistical information—including indexes and indicators—should guide the timing of data acquisition and the publication of information. The principle of management by exception is often a useful guide. Analysts responsible for monitoring or surveillance might examine raw and aggregated data for unusual or unanticipated variations and make further inquiries at an individual, institutional, or population level. The review and comments on information at all levels will influence the utility of both the initial input and the final product. The feedback process to lay persons, health care personnel, administrators, planners, and politicians is all part of an iterative sequence that enhances the value of the HIS for the people it serves and who pay for it. Money spent on useless health statistics cannot be spent on useful health care.

Evaluation

Implementation of the principles outlined in the previous sections should provide a substantial amount of continuing evaluation and a number of built-in, self-correcting processes. The several stages of evaluation include: those bearing on the credibility and adequacy of the input; the utility and timeliness of the output; the efficiency and economy of the entire operation, including respondent burden and the time of users to assimilate the information; the impact of the HIS on the overall

deployment and management of the jurisdiction's health resources; and, finally, those bearing on the impact of the HIS on the health status of the population.

In spite of continuing efforts at evaluation, most bureaucracies—especially those concerned with what may tend to become routine activities—tend to develop a life and momentum of their own. For that reason, it is probably desirable to have an external commission review the entire HIS periodically, perhaps every five or ten years. The addition of one or two consultants from outside the jurisdiction may even prove useful in some settings. In the final analysis, however, the most effective evaluation is likely to come from the quantitative demonstration that the HIS has indeed helped to improve the people's health.

Reorientation of Traditional Health Statistical Arrangements

The issue that faces traditional health statisticians in virtually every jurisdiction is: whether to become increasingly, or even solely, preoccupied with the essential tasks of registration of vital events and, especially in the more affluent areas, of assigning identifying numbers to documents; or whether to expand and extend their concepts and methods to develop health information systems directed toward helping the people and their health care enterprise improve the population's health status and well-being. Registration tasks are increasingly simple, technical exercises, akin to the registration of motor vehicles or the issuing of licenses to trade, but they have little to do with health or health care. Even in some developed nations, that almost sacred indicator of medical care, the infant mortality rate, unfortunately is being called into question; there is little doubt of its value in the least developed countries, especially for small-area comparisons. Birth weights and milestones in child development also may be sensitive and useful indicators of both the child's progress and potential, and the adequacy of the available health services.

The difficulties in reorienting traditional health statistical arrangements should not be underestimated. A hardy band of competent authorities will need to set this goal. Articles in professional journals, service on influential committees, discussion with politicians and senior administrators, teaching guides, textbooks, seminars, workshops, and conferences all can play a role.

Where the leaders of traditional health statistics systems seem unwilling or unable to expand and extend their thinking and practices, it may be simplest to reassign them to the registration functions to which their capability is self-limited. The contemporary leader in health statistics inevitably will have to contribute to the dynamic forces and

analytic techniques of modern management and government administration, as well as the increasingly practical application of information and organization theories. For example, those responsible for statistics on crops, harvests, the labor force, productivity, foreign trade, currency transactions, economic indicators, and meteorological forecasts have to provide information in timely fashion and clear format for practical use. The same is true of health information: Just as the former activities require a market or social orientation, so the health statistician requires an epidemiological and biological, if not clinical, orientation.

There also is a need to appreciate the limitations of national averages or other aggregated information, and to concentrate on comparisons and differential trends among various standardized rates for the intermediate and small-area peripheral levels.

In summary, survival of traditional health statistics, especially the vital registration component—the vitality of which has been waning steadily in many quarters—may be difficult, if not impossible, unless there are substantial changes introduced, and soon. So urgent are many current health problems that selective analyses of preventable deaths, the results of which could benefit the living, should be encouraged for even such traditional information as causes of death tabulations; this approach has been used effectively for maternal deaths associated with childbirth. It is again a selective and dynamic orientation that is needed, rather than a static one.

Education of Producers and Consumers of Health Information

In the absence of much active leadership from schools of medicine, public health, and hospital administration, the World Health Organization (WHO) has a major opportunity to make a fundamental and enduring contribution to the improvement of HISs. The first director-general of WHO, Dr. Brock Chisholm, introduced a useful and simple health profile 35 years ago. Called the PULHEMS[2] system, it could be adapted readily for use at all levels of health care. It lends itself to quantification and is understood easily by professionals, statisticians, and lay persons. This is just one example; many others of greater or lesser sophistication could be cited.

It is important to involve the producers of data, that is, the aides, auxiliaries, nurses, physicians, clerks, interviewers, and lower level managers, in suggesting simple ways of collecting essential data for multiple uses. Whenever feasible, any data bearing on a patient's health or care should be collected on the same document and at the same time the patient is given care, registered, or interviewed. Involvement of the

producers of data in the selection of terms and definitions and in the development of nomenclature and classification can be extremely productive. Feedback of selective output of the HIS that has a bearing on the clinician's (or health worker's) practice or on institutional management also can help to improve the quality and timeliness of input.

Consumers of health information should be involved in similar fashion in all phases of the development of the HIS. It may be desirable to start with a so-called Delphi process, which involves asking a number of central, intermediate, and peripheral (including institutional) administrators or managers to list the 10 (or 20) most important decisions they make daily (and/or weekly, monthly, or annually), together with the information they regard as essential or desirable for making these decisions. Such a process could be used to refine priorities, formats, and frequencies of the output to be generated by the HIS, as well as to encourge administrators to use information more purposefully and to support the appropriate expansion or refinement of the HIS and its components.

Most contemporary physicians are not numerate, and few think scientifically. Most statisticians know little about biological and psychological processes and less about the vagaries of clinical practice. The amount of money and the responsibilities for life and limb for which the managers of health care systems or even hospitals are responsible are of the same order of magnitude as those of the managers of airlines or the captains of jumbo jets, yet one hesitates to compare the two groups with respect to their managerial capacities or their insistence on and use of timely, relevant information.

Conclusion

It seems probable that global notions about health care, disease, medicine, human welfare, the role of technology, and the fate of the three billion children to be born before the year 2000 are undergoing major paradigmatic shifts. This is not the place to enlarge on these thoughts, but only to emphasize the fact that health information systems have both the responsibility for responding to these shifts and the opportunity to lead them. Finally, it may be worth noting that virtually all of the ideas, concepts, and methods discussed in this article have been tried or are known to be in various stages of development, testing, or application.

Notes

1. The denominator problem involves the identification of a statistical method for estimating the population served by a specific physician, clinic, or health center in the absence of any form of registration or assignment by geographical boundaries.

2. PULHEMS is an acronym for Physique, Upper limbs, Lower limbs, Hearing, Eyesight, Mental capacity, Stability of emotions.

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